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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

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For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 105
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 105
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 107
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 107
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 107
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 108
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 109
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 110
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 110
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 119
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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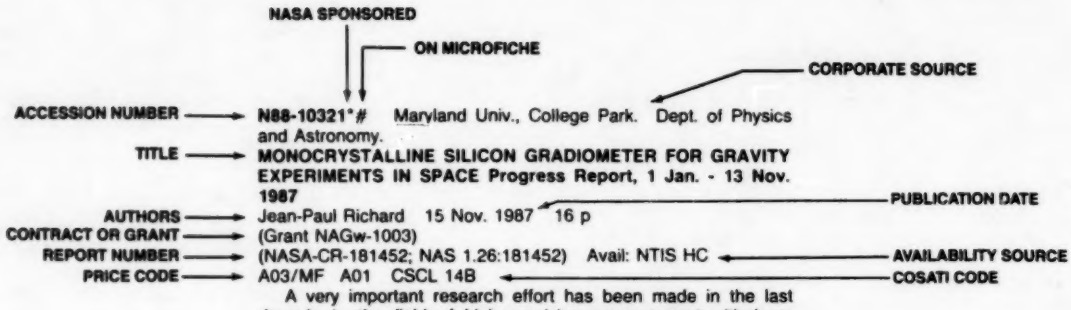
TYPICAL CITATION AND ABSTRACT



N88-10321*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

MONOCRYSTALLINE SILICON GRADIOMETER FOR GRAVITY EXPERIMENTS IN SPACE Progress Report, 1 Jan. - 13 Nov. 1987

Jean-Paul Richard 15 Nov. 1987 16 p

(Grant NAGw-1003)

(NASA-CR-181452; NAS 1.26:181452) Avail: NTIS HC

A03/MF A01 CSCL 14B

A very important research effort has been made in the last decade in the field of high precision measurement with laser instrumentation. The development of a space borne gradiometer operating at a high sensitivity level using laser measurement of the distance between proof mass over a short base line of order one meter is discussed. Two aspects of laser technology make it a promising tool for gradiometry measurements: quantum limited accuracy and absolute distance measurements. The quantum limit associated with laser instrumentation was formulated. The relevant quantum and classical sources of errors in laser measurements were reviewed and corresponding laser performance requirements for gradient measurements were evaluated. Some mechanical quality factor measurements were made on simple resonant monocrystalline silicon suspensions. It was discovered that the use of zero derivative restoring forces to position the gradiometer test masses will dramatically reduce the gradiometer temperature control requirements. A laser beam side injection scheme was discovered which permits rejection of common mode accelerations. These concepts are briefly discussed. Author

VOLUME 26 NUMBER 1 / JANUARY 8, 1988

Scientific and Technical Aerospace Reports

01 AERONAUTICS (GENERAL)

N88-10001# Oak Ridge National Lab., Tenn.
NAVAL AVIATION INTEGRATED LOGISTICS: TECHNICAL USERS GUIDE VERSION 1.0
R. C. DeLozier and D. A. Holder Jun. 1987 330 p
(Contract DE-AC05-84OR-21400)
(DE87-013368; ORNL/TM-10316) Avail: NTIS HC A15/MF A01

The operational and analytical functions of version 1.0 of the Naval Aviation Integrated Logistic (NAIL) package are summarized. NAIL, a logistics management and analysis system, creates standardized reports and performs several categories of statistical operations in support of NAVAIR logistic analytic functions. DOE

N88-10002*# National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 218)
Oct. 1987 137 p
(NASA-SP-7037(218); NAS 1.21:7037(218)) Avail: NTIS HC A07 CSCL 01A

This bibliography lists 469 reports, articles, and other documents introduced into the NASA scientific and technical information system in September, 1987. Author

N88-10003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Stabilitaet und Antwort.
THE HISTORY OF AEROELASTICITY RESEARCH IN GERMANY FROM THE BEGINNING UNTIL 1945
Peter Bublitz Dec. 1986 319 p In GERMAN; ENGLISH summary Report will also be annouced as translation (ESA-TT-1082)
(DFVLR-Mitt-86-25; ISSN-0176-7739; ETN-87-90444) Avail: NTIS HC A14/MF A01; DFVLR, Cologne, West Germany DM 98

Twenty years elapsed between the beginning of powered flight and the comprehension of such aeroelasticity problems as static divergence and flutter. The way in which the first aeroelasticians overcame the difficulties and founded this field of research is described. ESA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N88-10004 Michigan Univ., Ann Arbor.
REYNOLDS NUMBER EFFECTS ON THE SMALL SCALE STRUCTURE OF A TURBULENT CHANNEL FLOW Ph.D. Thesis
Timothy Wei 1987 190 p
Avail: Univ. Microfilms Order No. DA8712238

An experimental investigation was conducted to determine if universal scaling in fully developed turbulent channel flows exists. Specifically, this study demonstrates a strong Reynolds number effect in the near wall region of a channel. Two color, two component Laser Doppler Anemometer measurements were made over a Reynolds number range of 3,000 to 40,000. The combination of high spatial resolution and high data rates enabled accurate reconstruction of time dependent velocity traces. Long time statistical averages of these signals clearly show that turbulence quantities such as turbulence intensities, Reynolds stress, and turbulent kinetic energy production are strongly Reynolds number dependent even very close to the wall (y sup + = 15). The velocity traces and associated power spectra exposed two phenomena which may explain the Reynolds number dependencies. First, the near wall vorticity field is stretched with Reynolds number to a degree greater than that dictated by inner scaling laws. Second, the inner region structure from opposing walls interact, particularly at low Reynolds numbers.
Dissert. Abstr.

N88-10005# Karlsruhe Univ. (West Germany). Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke.
POSSIBILITIES FOR THE MODELING OF DYNAMICALLY LOADED CYLINDRICAL STRUCTURAL PARTS IN THE WIND TUNNEL [MODELLIERUNGSMOEGLICHKEITEN DER DYNAMISCHEN BELASTUNG ZYLINDRISCHER BAUWERKE IM WINDKANAL]
F. Menacher and J. Maier-Erbacher 1987 38 p In GERMAN
(KU-SFB-210/T/24; ETN-87-90370) Avail: NTIS HC A03/MF A01

The loading of cylindrical structures by the natural wind and its modelling in the wind tunnel were investigated to obtain information on random loading of thin structures. The fundamentals of random vibrations of structures under wind loading, namely the theory of multiple input linear systems, are presented. The theoretical and experimental determination of the wind speed correlations and the pressure on the structure are discussed. Theoretically as well as experimentally the vertical and horizontal transfer functions, describing the relation between speed and pressure, were separately analyzed. The errors due to this separation are discussed. The comparison between natural model measurements becomes difficult if de-integrated vortex parts reach the cylindrical structure. ESA

N88-10006# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
A TRANSONIC MODEL REPRESENTATION FOR TWO-DIMENSIONAL WALL INTERFERENCE ASSESSMENT
J. Smith Feb. 1986 23 p
(NLR-TR-86026-U; B8709827; ETN-87-90823) Avail: NTIS HC A03/MF A01

It is shown that for a two-dimensional airfoil a subsonic formulation may underestimate the actual displacement effect by up to 50% for supercritical flow conditions. Extension of the subsonic model representation by a transonic doublet, derived in an approximative way, is shown to constitute a considerable improvement. ESA

N88-10007*# FWG Associates, Inc., Tullahoma, Tenn.
ANALYSES AND ASSESSMENTS OF SPAN WISE GUST GRADIENT DATA FROM NASA B-57B AIRCRAFT Final Report
Walter Frost, Ho-Pen Chang, and Erik A. Ringnes Aug. 1987 350 p
(Contract NAS1-17989)
(NASA-CR-178288; NAS 1.26:178288) Avail: NTIS HC A15/MF A01 CSCL 01A

Analysis of turbulence measured across the airfoil of a Cambera B-57 aircraft is reported. The aircraft is instrumented with probes for measuring wind at both wing tips and at the nose. Statistical properties of the turbulence are reported. These consist of the standard deviations of turbulence measured by each individual probe, standard deviations and probability distribution of differences in turbulence measured between probes and auto- and two-point spatial correlations and spectra. Procedures associated with calculations of two-point spatial correlations and spectra utilizing data were addressed. Methods and correction procedures for assuring the accuracy of aircraft measured winds are also described. Results are found, in general, to agree with correlations existing in the literature. The velocity spatial differences fit a Gaussian/Bessel type probability distribution. The turbulence agrees with the von Karman turbulence correlation and with two-point spatial correlations developed from the von Karman correlation. Author

N88-10008*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED TURBOPROP WING INSTALLATION EFFECTS MEASURED BY UNSTEADY BLADE PRESSURE AND NOISE
Laurence J. Heidelberg and Richard P. Woodward 1987 23 p Presented at the 11th Aeroacoustics Conference, Sunnyvale, Calif., 19-21 Oct. 1987; sponsored by AIAA
(NASA-TM-100200; E-3737; NAS 1.15:100200; AIAA-87-2719) Avail: NTIS HC A03/MF A01 CSCL 01A

A single rotation model propeller (SR-7A) was tested at simulated takeoff/approach conditions (Mach 0.2), in the NASA Lewis 9- by 15-Ft Anechoic Wind Tunnel. Both unsteady blade surface pressures and noise measurements were made for a tractor configuration with propeller/straight wing and propeller alone configurations. The angle between the wing chord and propeller axis (droop angle) was varied along with the wing angle of attack to determine the effects on noise and unsteady loading. A method was developed that uses unsteady blade pressure measurements to provide a quantitative indication of propeller inflow conditions, at least for a uniform (across the propeller disk) inflow angle. The wing installation caused a nearly uniform upwash at the propeller inlet as evidenced by the domination of the pressure spectra by the first shaft order. This inflow angle increased at a rate of almost 150 percent of that of the wing angle-of-attack for a propeller-wing spacing of 0.54 wing chords at a constant droop angle. The flyover noise, as measured by the maximum blade passing frequency level, correlates closely with the propeller inflow angle (approx. 0.6 dB per degree of inflow angle) for all droop angles and wing angles of attack tested, including the propeller alone data. Large changes in the unsteady pressure responses on the suction surface of the blade were observed as the advance ratio was varied. The presence of a leading edge vortex may explain this behavior since changes in the location of this vortex would change with loading (advance ratio). Author

N88-10009*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL INVESTIGATION OF A FULL-SCALE GENERAL AVIATION AIRPLANE EQUIPPED WITH AN ADVANCED NATURAL LAMINAR FLOW WING
Daniel G. Murri and Frank L. Jordan, Jr. Nov. 1987 136 p
(NASA-TP-2772; L-16283; NAS 1.60:2772) Avail: NTIS HC A07/MF A01 CSCL 01A

An investigation was conducted in the Langley 30- by 60-Foot Wind Tunnel to evaluate the performance, stability, and control characteristics of a full-scale general aviation airplane equipped with an advanced laminar flow wing. The study focused on the effects of natural laminar flow and advanced boundary layer transition on performance, stability, and control, and also on the effects of several wing leading edge modifications on the stall/departure resistance of the configuration. Data were measured over an angle-of-attack range from -6 to 40 deg and an angle-of-sideslip range from -6 to 20 deg. The Reynolds number was varied from 1.4 to 2.4 x 10 to the 6th power based on the mean aerodynamic chord. Additional measurements were made using hot-film and sublimating chemical techniques to determine the condition of the wing boundary layer, and wool tufts were used to study the wing stall characteristics. The investigation showed that large regions of natural laminar flow existed on the wing which would significantly enhance cruise performance. Also, because of the characteristics of the airfoil section, artificially tripping the wing boundary layer to a turbulent condition did not significantly effect the lift, stability, and control characteristics. The addition of a leading-edge droop arrangement was found to increase the stall angle of attack at the wingtips and, therefore, was considered to be effective in improving the stall/departure resistance of the configuration. Also the addition of the droop arrangement resulted in only minor increases in drag. Author

N88-10010# Office of Naval Research, London (England).
INTERNATIONAL CONFERENCE ON THE AERODYNAMICS AT LOW REYNOLDS NUMBERS BETWEEN 10(4) AND 10(6)
Thomas J. Mueller 31 Aug. 1987 19 p Conference held in London, England, 15-18 Oct. 1986
(ONRL-7-023-C) Avail: NTIS HC A03/MF A01

Presentations made at the International Conference on Aerodynamics at Low Reynolds Numbers, which took place in London from 15 to 18 October 1986, are reviewed. Topics include airfoil design methods and verification, airfoil calculation methods, low Reynolds number research at NASA Langley Research Center, unsteady aerodynamic characteristics, wind turbine applications, separation bubbles, experimental facilities and testing, and remotely piloted vehicles. Author

N88-10011*# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
THE STRUCTURE OF SEPARATED FLOW REGIONS OCCURRING NEAR THE LEADING EDGE OF AIRFOILS INCLUDING TRANSITION Semiannual Status Report, May - Oct. 1987
Thomas J. Mueller Oct. 1987 37 p
(Grant NsG-1419)
(NASA-CR-181434; NAS 1.26:181434) Avail: NTIS HC A03/MF A01 CSCL 01A

All the time and effort was directed toward acquiring, reducing, and analyzing more hot-wire anemometer data. Some static pressure distribution data were also acquired to support the analysis of the velocity profile data. Laser Doppler Velocimetry data were not acquired due to equipment problems. Included were seven combinations of chord Reynolds number, angle of attack, and acoustic forcing using the NACA 663-018 airfoil. This research has as its objective the detailed documentation of the structure and behavior of the transitional separation bubble and the redeveloping boundary layer after reattachment over an airfoil at low Reynolds numbers. The intent is to further the understanding of the complex flow phenomena so that analytic methods for predicting their formulation and development can be improved. These analytic techniques have applications in the design and performance prediction of airfoils operating in the low Reynolds number flight regime. Author

N88-10012*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
INTEGRATION OF DYNAMIC, AERODYNAMIC AND STRUCTURAL OPTIMIZATION OF HELICOPTER ROTOR BLADES Semiannual Status Report No. 2, 14 Apr. - 13 Oct. 1987
David A. Peters 2 Nov. 1987 34 p
(Grant NAG1-710)
(NASA-CR-181441; NAS 1.26:181441) Avail: NTIS HC A03/MF A01 CSCL 01A

(NASA-CR-181441; NAS 1.26:181441) Avail: NTIS HC A03/MF A01 CSCL 01A

The purpose of the research is to study the integration of structural, dynamic, and aerodynamic considerations in the design-optimization process for helicopter rotorblades. This is to be done in three phases. Task 1 is to bring on-line computer codes that could perform the finite-element frequency analyses of rotor blades. The major features of this program are summarized. The second task was to bring on-line an optimization code for the work. Several were tried and it was decided to use CONMIN. Explicit volume constraints on the thicknesses and lumped masses used in the optimization were added. The specific aeroelastic constraint that the center of mass must be forward of the quarter chord in order to prevent flutter was applied. The bending-torsion coupling due to cg-ea offset within the blade cross section was included. Also included were some very simple stress constraints. The first three constraints are completed, and the fourth constraint is being completed. B.G.

N88-10013*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.

TRANSONIC ANALYSIS AND DESIGN OF AXISYMMETRIC BODIES IN NONUNIFORM FLOW

Jen-Fu Chang and C. Edward Lan Nov. 1987 77 p (Grant NAG1-308)

(NASA-CR-4101; NAS 1.26:4101; CRINC-FRL-602-3) Avail: NTIS HC A05/MF A01 CSCL 01A

An inviscid nonuniform axisymmetric transonic code was developed for applications in analysis and design. Propfan slipstream effect on pressure distribution for a body with and without sting was investigated. Results show that nonuniformity causes pressure coefficient to be more negative and shock strength to be stronger and more rearward. Sting attached to a body reduced the pressure peak and moves the rear shock forward. Extent and Mach profile shapes of the nonuniformity region appeared to have little effect on the pressure distribution. Increasing nonuniformity magnitude made pressure coefficient more negative and moved the shock rearward. Design study was conducted with the CONMIN optimizer for an ellipsoid and a body with the NACA-0012 counter. For the ellipsoid, the general trend showed that to reduce the pressure drag, the front portion of the body should be thinner and the contour of the rear portion should be flatter than the ellipsoid. For the design of a body with a sharp trailing edge in transonic flow with an initial shape given by the NACA-0012 contour, the pressure drag was reduced by decreasing the nose radius and increasing the thickness in the aft portion. Drag reduction percentages are given. Author

N88-10014# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

DISPERSION IN THE WAKE OF AIRCRAFT: AN INVESTIGATION OF THE EFFECTS OF A GROUND PLANE ON TRAILING VORTICES. LITERATURE SURVEY

J. K. Harvey and T. R. Steiner Jun. 1986 69 p

(IC-Aero-Rep-86-04; ISSN-0308-7247; ETN-87-90689) Avail: NTIS HC A04/MF A01

Physical processes of trailing vortice are discussed, and the complexities and subtleties of aircraft wake flow are explored. A literature survey detects little work of direct relevance to the problem of dispersion of aircraft wake material, especially near the ground. However, problems and likely areas of useful research are identified. ESA

N88-10015# Technische Univ., Berlin (West Germany). Fachbereich Verkehrswesen.

A METHOD FOR THE CALCULATION OF TRANSONIC FLOWS FOR THE CONTROL OF ADAPTIVE WIND TUNNELS Ph.D. Thesis [VERFAHREN ZUR BERECHNUNG TRANSSONISCHER STROEMUNGEN FUER DIE REGELUNG ADAPTIVER WINDKANAELE]

Rainer Rebstock 1986 122 p In GERMAN Sponsored by the Bundesministerium fuer Forschung und Technologie, West Germany

(ETN-87-90411) Avail: NTIS HC A06/MF A01

Numerical methods for the adjustment of three-dimensional, adaptive test sections for wind tunnel walls were developed. The required wall form was designed by the stepwise modification of a starting contour. The bad convergence characteristics of the classical iterative adaptive method in the three-dimensional case were demonstrated theoretically and by a numerical simulation. It is shown that the replacement of the constant control factor by a matrix, which takes into account the remote Mach number and the test section geometry, allows the calculation of the adapted wall contour practically in one step. A method for the testing of three-dimensional models in wind tunnels with two flexible walls is proposed. Wall deviations, allowing the suppression of interferences on the model axis, are proposed. ESA

N88-10016# Technische Hochschule, Darmstadt (West Germany). Fachbereich Maschinenbau.

INVESTIGATIONS OF SEPARATED FLOW STATES ON WINGS OF MEDIUM ASPECT RATIO TAKING INTO ACCOUNT THE WIND TUNNEL INTERFERENCE PROBLEM Ph.D. Thesis [UNTERSUCHUNGEN ABGELOESTER STROEMUNGSZUSTAENDE AN TRAGFLUEGELN MITTLERER STRECKUNG UNTER BERUECKSICHTIGUNG DES WINDKANALINTERFERENZ-PROBLEMS PROBLEMS]

Johannes Keil 1985 208 p In GERMAN

(ETN-87-90437) Avail: NTIS HC A10/MF A01

Wind tunnel experiments were conducted for the investigation of separated, subsonic flow about wings in the range of high angles of attack. The pressure distributions and aerodynamic coefficients of the wings were measured. The effect of the design parameters on the separation behavior was deduced from measurements on five wings of equal aspect ratio, but different sweep. The measurements were evaluated with a calculation method which considers the buoyancy as well as the displacement correction. Corrections were determined for the open and the closed wind tunnel test section with circular cross section with a straight rectangular wing. ESA

N88-10017# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Hauptabteilung Windkanaele.

EXPERIMENTAL INVESTIGATION IN A WIND TUNNEL OF THE STABILITY AND VORTICITY OF THE VORTEX BREAKDOWN PHENOMENON ABOVE DELTA WINGS, USING THE ULTRASONIC LASER METHOD Ph.D. Thesis - Goettingen Univ., West Germany

Rolf H. Engler Feb. 1987 88 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-1079)

(DFVLR-FB-87-06; ISSN-0171-1342; ETN-87-90453) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 30.50

A contactless acousto-optical measuring technique, the ultrasonic laser method, was developed for the study of vortices. Wind tunnel arrangements and the acousto-optical method for the determination of ultrasonic time of flight differences are described. The results of measurement series in seven planes in front of the point of vortex breakdown give detailed information on the velocity and circulation distribution inside a vortex. It is shown that the radial region between the viscous core and Hall's characteristic core radius has four turns of the spiral shear layer. The jumps of circulation at each rotation were measured; there is potential flow between them. Ludwieg's theory is proved, meaning that the shape parameter falls below the critical value of 1.16 behind the point of vortex breakdown. ESA

N88-10018# Royal Aircraft Establishment, Farnborough (England).

ON THE PROSPECTS FOR INCREASING DYNAMIC LIFT

D. G. Mabey May 1986 37 p

(RAE-TM-AERO-2068; BR100237; ETN-87-90955) Copyright Avail: NTIS HC A03/MF A01

Research, mainly at low speeds, into the development of dynamic lift is reviewed. Sudden movement of aerodynamic surfaces can generate dynamic lift due to the transient development of separated flow. These dynamic effects are large and well established for airfoils. They are considered likely to be small for highly swept wings and negligible for slender wings, but there is little experimental evidence to support this inference. Dynamic lift might be increased if conventional sinusoidal motions can be replaced by appropriate periodic sawtooth motions. The control of large-scale flow separations by rapid movements of aerodynamic surfaces requires further investigation and a program of wind tunnel tests to resolve controversial issues is suggested. ESA

N88-10019# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Abteilung Turbulenzforschung.
A NOTE ON THE INSTABILITY OF A VORTEX SHEET LEAVING A SEMI-INFINITE PLATE
Alfons Michalke and Peter Plaschko (Technische Univ., Berlin, West Germany) Apr. 1987 29 p
(DFVLR-FB-87-16; ISSN-0171-1342; ETN-87-91008) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 10

The results pertaining to the inviscid instability of a vortex sheet leaving a semi-infinite plate derived by Orszag and Crow (1970) and by Bechert and Michel (1975) were examined. While the former find a solution of the problem which, however, does not satisfy the full Kutta condition, the latter stated that without excitation by sources only the trivial solution exists. It is found that both methods agree completely, but that the no-Kutta-condition solution of Orszag and Crow, in the sense of Bechert and Michel, reflects the existence of a vortex sheet excited by a special dipole sheet along the plate. It is shown that for vortex sheet problems the use of the pressure instead of the velocity potential is more convenient. It is proved that the Wiener-Hopf equation of the present problem corresponds to the differential equation for the vortex sheet displacement derived by Bechert and Michel. ESA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N88-10020# Luftfahrt-Bundesamt, Brunswick (West Germany). Flugunfalluntersuchungsstelle.
AIRCRAFT ACCIDENTS Annual Report, 1984 [FLUGUNFALL JAHRESBERICHT, 1984]
Sep. 1986 120 p In GERMAN
(JB-84; ISSN-0178-8094; ETN-87-90396) Avail: NTIS HC A06/MF A01

All accidents in 1984 with German aircraft at home and abroad, as well as with foreign aircraft in Germany, which were announced to the aircraft investigation service, are listed. Concepts used in the examination of aircraft accidents are explained. The accidents are listed for aircrafts above 5.7T, between 2 and 5.7T, below 2T, helicopters, powered gliders, gliders, parachutes, hang gliders, ultralight aircraft, balloons, and other types of aircraft. ESA

N88-10021*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FULL-SCALE TRANSPORT CONTROLLED IMPACT DEMONSTRATION PROGRAM Final Summary Report
Sep. 1987 82 p Prepared in cooperation with NASA, Ames Research Center, Moffett Field, Calif. and FAA, Atlantic City, N.J.
(NASA-TM-89642; NAS 1.15:89642; DOT/FAA/CT-87/10) Avail: NTIS HC A05/MF A01 CSCL 01C

The Federal Aviation Administration (FAA) and NASA conducted a full-scale air-to-surface impact-survivable impact demonstration with a remotely piloted transport aircraft on 1 December 1984, at Edwards Air Force Base, California. The test article consisted of experiments, special equipment, and supporting systems, such as antimisting kerosene (AMK), crashworthiness structural/restraint, analytical modeling, cabin fire safety, flight data recorders, post-impact investigation, instrumentation/data acquisition systems, remotely piloted vehicle/flight control systems, range and flight safety provisions, etc. This report describes the aircraft, experiments, systems, activities, and events which lead up to the Controlled Impact Demonstration (CID). An overview of the final unmanned remote control flight and sequence of impact events are delineated. Preliminary post CID observations are presented.
Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N88-10022# Sener, S.A., Madrid (Spain).
ACCURATE POSITION MEASURING SPACECRAFT PACKAGE Final Report
J. Deza, C. Reines, E. Domingo, F. Mata, C. Carnebianca, G. Solari, and A. Corbasi Paris, France ESA Sep. 1986 637 p
(Contract ESA-6239/85-NL-PP(SC))
(ESA-CR(P)-2398-Vol-1; ETN-87-90532) Avail: NTIS HC A99/MF A01

User equipment for LEO spacecraft positioning using NAVSAT and GPS is defined, and a development approach is outlined. It is concluded that both systems are cost effective. When the high performance P-Code receiver is required, the implementation of existing U.S. equipment in collaboration with American firms is reccmmended. This offers lower risks and lower investment by European resources, compared to a full European development. For applications where C/A code receivers can be used a study phase is recommended in order to define and evaluate the required changes over the existing European C/A receiver developments to decide upon the suitability of the modified receivers for space applications. Regarding Columbus as a candidate to carry a GPS receiver, simulations and ground tests are recommended in favor of an earlier experimental mission. Columbus would be very costly and the feasibility of using GPS as a spacecraft navigation system is already established in experimental missions. ESA

N88-10023# Sener, S.A., Madrid (Spain).
ACCURATE POSITION MEASURING SPACECRAFT PACKAGE, EXECUTIVE SUMMARY Final Report
J. Deza, C. Reines, E. Domingo, F. Mata, C. Carnebianca, G. Solari, and A. Corbasi Paris, France ESA Sep. 1986 34 p
(Contract ESA-6239/85-NL-PP(SC))
(ESA-CR(P)-2398-Vol-2; ETN-87-90533) Avail: NTIS HC A03/MF A01

User equipment for LEO spacecraft positioning using Navsat and GPS is defined, and a development approach is outlined. It is concluded that both systems are cost effective. When the high performance P-Code receiver is required, the implementation of existing U.S. equipment in collaboration with American firms is recommended. This offers lower risks and lower investment by European resources, compared to a full European development. For applications where C/A code receivers can be used a study phase is recommended in order to define and evaluate the required changes over the existing European C/A receiver developments to decide upon the suitability of the modified receivers for space applications. Regarding Columbus as a candidate to carry a GPS receiver, simulations and ground tests are recommended in favor of an earlier experimental mission. Columbus would be very costly and the feasibility of using GPS as spacecraft navigation system is already established in experimental missions. ESA

N88-10024# Racal-Decca Advanced Development Ltd., Walton-on-Thames (England).
IMPLICATIONS OF A SIMPLIFIED SIGNAL STRUCTURE FOR NAVSAT Final Report
P. D. Britten, P. Diederich, S. G. Hazeltine, P. Hyde, and S. S. D. Jones Paris, France ESA Jan. 1987 95 p
(Contract ESA-6393/85-F-RD)
(Rept-63/1439; ESA-CR(P)-2404; ETN-87-90539) Copyright Avail: NTIS HC A05/MF A01

The Navsat signal format was redefined to reflect the fact that compared to the transmission of the PRN ranging signal, twice the amount of satellite power is allowed in the power budget to the broadcast of ephemeris data in BPSK, and the constellation changed from 24 satellites in 12 hr circular inclined orbits to a configuration of 6 geosynchronous satellites and 12 satellites in highly elliptic 12 hr inclined orbits. In order to accommodate broadcasting of satellite position or ephemeris data, a short PRN code was chosen which retains the ranging accuracy of the original signal structure. Its short duration introduces multiple range ambiguities which must be resolved by additional means. The satellite power originally concentrated in the carrier was distributed over five tones to provide a two stage tone ranging structure. It possesses the required level of integrity to satisfy the ambiguity needs of a short PRN code and to provide, in its own right, the means of inexpensive navigation for the leisure market and for distress applications. ESA

N88-10025# European Space Agency, Paris (France).
TEST EQUIPMENT WITH FIBER OPTIC DATA BUS AND LASER GYRO STRAPDOWN SYSTEM LTN-90 FOR THE HELICOPTER BO-105
Hans-Juergen Hotop and Hans-Peter Zenz Apr. 1987 49 p Transl. into ENGLISH of Aufbau einer Messtechnik mit Lichtleitfasern und einem Laserkreisel-Strapdown-System LTN-90 im Hubschrauber BO-105 (Brunswick, Fed. Republic of Germany, DFVLR) 1985 Original language document announced as N86-17333
(ESA-TT-1038; DFVLR-Mitt-85-10; ETN-87-90669) Avail: NTIS HC A03/MF A01; original report in German available from DFVLR, Cologne, West Germany DM 19

The measuring instruments with a MUDAS interface system for flight-testing navigation systems in the helicopter BO-105 are described. The bit-serial bus was constructed using fiber optics. The reference data from a laser gyro strapdown navigation system were corrected by application of optimal filter techniques and external measurements. The results of testing the overall system are presented, and the accuracy of the development of the reference trajectory compared with the data of the laser radar PATS is explained with reference to a test flight. ESA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.For land transportation vehicles see *85 Urban Technology and Transportation*.

N88-10026*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIMAT FLIGHT PROGRAM: TEST RESULTS AND PROGRAM ASSESSMENT OVERVIEW
Dwain A. Deets, V. Michael DeAngelis, and David P. Lux Jun. 1986 30 p
(NASA-TM-86725; H-1283; NAS 1.15:86725) Avail: NTIS HC A03/MF A01 CSCL 01C

The Highly Manueverable Aircraft Technology (HiMAT) program consisted of design, fabrication of two subscale remotely piloted research vehicles (RPRVs), and flight test. This technical memorandum describes the vehicles and test approach. An overview of the flight test results and comparisons with the design predictions are presented. These comparisons are made on a single-discipline basis, so that aerodynamics, structures, flight controls, and propulsion controls are examined one by one. The interactions between the disciplines are then examined, with the conclusions that the integration of the various technologies contributed to total vehicle performance gains. An assessment is made of the subscale RPRV approach from the standpoint of research data quality and quantity, unmanned effects as compared with manned vehicles, complexity, and cost. It is concluded that the RPRV technique, as adopted in this program, resulted in a more complex and costly vehicle than expected but is reasonable when compared with alternate ways of obtaining comparable results. Author

N88-10027# LTV Missiles and Electronics Group, Dallas, Tex. Missiles Div.
DESIGN PRINCIPLES AND PRACTICES FOR IMPLEMENTATION OF MIL-STD-1760 IN AIRCRAFT AND STORES Final Report, Jul. - Dec. 1986
D. E. Lautner, A. J. Marek, W. M. Drum, and R. R. Fernandez Jun. 1987 432 p
(Contract N60530-85-C-0091)
(AD-A183724; Rept-3-52110-6R-128) Avail: NTIS HC A19/MF A01 CSCL 01C

The trends in weapon system designs (aircraft and stores) has resulted in a growing concern over the general proliferation of aircraft-to-store electrical interfacing requirements and the resulting high cost to achieve interoperability between aircraft and stores. MIL-STD-1760 was prepared to reduce the aircraft/store electrical integration problem by specifying a standard electrical interface between aircraft and stores. The standard electrical interface is based on recognized trends in store management systems which use serial digital transmission for control, monitor, and release of stores. This report deals with the interoperability requirements as described in MIL-STD-1760 and is intended to be an aid to understanding and meeting the requirements for both current and future weapon systems. In general, this report provides the following: (1) An overview of MIL-STD-1760 requirements, exclusions and future growth provisions. (2) Detail design considerations applicable to the Aircraft Station Interface (ASI). (3) Detail design considerations applicable to the Mission Store Interface (MSI). (4) Aircraft/Store Physical Design Considerations. (5) A commentary on the requirements in MIL-STD-1760. GRA

N88-10028# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
PROBLEM AND SOLUTION FORMULATIONS FOR THE GENERATION OF 3D BLOCK-STRUCTURED GRIDS
J. W. Boerstoel 3 Mar. 1986 16 p Presented at the 1st International Conference on Numerical Grid Generation in Computational Fluid Dynamics, 14-17 Jul. 1986, Landshut, Fed. Republic of Germany
(NLR-MP-86020-U; B8701063; ETN-87-90825) Avail: NTIS HC A03/MF A01

The technical concepts of a method for the generation of 3D block-structured grids are presented. The generation process is decomposed in four steps: topological block decomposition; geometrical modeling of known and unknown coordinate functions; grid initialization by multilinear transfinite interpolation; and elliptic cell partitioning. The elliptic method is based on simple partial differential equations representing locally decoupled ID stretchings followed by 3D rotations. Mesh-size and smoothness control occurs with user-provided weight functions that are inversely proportional to desired mesh sizes. Test results are shown. ESA

N88-10029# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugzeugsteuerung und- Regelung.
AN OBSERVER APPROACH TO THE ESTIMATION OF HELICOPTER AIRSPEED Ph.D. Thesis - Technische Univ.
Burkhard Mueller Apr. 1987 152 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-13; ISSN-0171-1342; ETN-87-90597) Avail:

NTIS HC A08/MF A01; DFVLR, Cologne, West Germany DM 52.50

Difficulties in measuring the airspeed of helicopters because of low dynamic pressures in the low airspeed regime and because of the rotor downwash influencing the flow field around the fuselage are reviewed, and a nonlinear state observer for the estimation of helicopter airspeed is described. Uncertainties in the models of helicopter dynamics affect the method. A procedure that allows a simple adaptation of the models to real conditions is presented. It is shown that parameter sensitivity can be reduced and the low static stability regime can be handled. The results are verified by flight tests. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N88-10030*# Battelle Columbus Labs., Ohio.
DIGITAL SYSTEM BUS INTEGRITY Final Report
Donald Eldredge and Ellis F. Hitt Mar. 1987 100 p Prepared in cooperation with Lockheed-Georgia Co., Marietta
(Contract NAS2-11853)
(NASA-CR-181446; NAS 1.26:181446; DOT/FAA/CT-86/44)
Avail: NTIS HC A05/MF A01 CSCL 01D

This report summarizes and describes the results of a study of current or emerging multiplex data buses as applicable to digital flight systems, particularly with regard to civil aircraft. Technology for pre-1995 and post-1995 timeframes has been delineated and critiqued relative to the requirements envisioned for those periods. The primary emphasis has been an assured airworthiness of the more prevalent type buses, with attention to attributes such as fault tolerance, environmental susceptibility, and problems under continuing investigation. Additionally, the capacity to certify systems relying on such buses has been addressed. Author

N88-10031# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Anthropotechnik und Simulation.
COLOR DISPLAY PROGRAMMING FOR AVIATION
Hermann Wiesner Nov. 1986 52 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-87-03; ISSN-0176-7739; ETN-87-90447) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 37

A software concept for electronic displays suitable for a variety of applications in aviation was developed. The hardware of the display system is outlined. The programs for the symbol generator, microprocessor-bipolar, and fixed blanking windows are described. The software was implemented for the proven display technology flown in the Airbus A-310 aircraft. In the light of future developments in display technology, the software provides more features than can be utilized with the hardware currently employed. Electronic displays for a helicopter were taken to demonstrate the software details. ESA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N88-10032 Arizona State Univ., Tempe.
MODELING AND MEASUREMENT OF HEAT TRANSFER ON TURBINE BLADE TIPS Ph.D. Thesis
Hee-Koo Moon 1987 229 p
Avail: Univ. Microfilms Order No. DA8711465

Local mass transfer measurements are made for flow through a narrow slot-type channel where one of the boundary walls contains a transverse rectangular cavity and the other is in motion. The study models heat transfer on the grooved tips of axial turbine blades. A naphthalene sublimation technique together with a microcomputer-controlled measurement system provides detailed local mass transfer information. Overall mass transfer is not measurable affected by the moving boundary for cavity depth-to-width ratios of 0.10, 0.25, 0.50, 1.00, and 1.50. As cavity depth increases, overall mass transfer stays essentially the same until the immediate depth-to-width ratio of 0.5 is reached, then increases. The direction of the moving wall relative to the mean flow direction does not effect the overall mass transfer but does change local distributions, especially on the cavity floor and side walls. Stanton number averaged over the entire tip area decreases exponentially with gap Reynolds number over the test range of .38 to 3.6 x 10 to the 4th power, but overall mass transfer increases. Gap clearance is inversely related to overall mass transfer and influences significantly the local mass transfer distribution in the gap regions. Dissert. Abstr.

N88-10033# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
FLAME DRIVING OF LONGITUDINAL INSTABILITIES IN LIQUID FUELED DUMP COMBUSTORS Final Report, 1 Jul. 1984 - 30 Jun. 1987
Ben T. Zinn, Uday G. Hegde, Dierk Reuter, and B. R. Daniel 1 Jul. 1987 114 p
(Contract N00014-84-K-0470)
(AD-A183536) Avail: NTIS HC A06/MF A01 CSCL 21B

This report describes the results of experimental and theoretical investigations of the mechanisms by which the core flow combustion process in coaxial, single inlet, dump type ramjet engines drives longitudinal combustion instabilities. To this end, the behavior of V-shaped flames, similar to those often occurring in ramjet combustors, stabilized in longitudinal acoustic fields has been studied. The presence of burning vortical structures is observed in the flame region. These structures appear at frequencies close to the first natural acoustic frequency of the combustor and are believed to be connected with a shear layer type of instability of the flame. Experiments conducted show that the unsteady combustion in these structures is capable of driving the acoustics at the fundamental acoustic mode frequency. With increase in fuel air ratio, a spontaneous instability involving the fundamental mode is observed and explained in terms of increased driving associated with the higher, unsteady heat release rates. The results of experiments conducted with external acoustic excitation of the flame at different frequencies are also reported and confirm the idea that the vortical structures arise due to a fluid mechanical instability of the flame. It is shown that the interactions between the vortical structures and the system's acoustic field affect the heat release rates from the flame and provide a mechanism for the driving of longitudinal mode instabilities. GRA

N88-10034# Naval Postgraduate School, Monterey, Calif.
OPTICAL SIZING OF SOOT IN GAS TURBINE COMBUSTORS AND EXHAUST AUGMENTOR TUBES M.S. Thesis
Mark F. Young Mar. 1987 50 p
(AD-A183785) Avail: NTIS HC A03/MF A01 CSCL 17E

An experimental investigation was conducted to examine optical sizing techniques in gas turbine combustors and exhaust augmentor tubes. The two primary objectives of this thesis were to improve the accuracy of optical particle sizing in the combustor and across the augmentor tube, and to verify the improved capabilities with a test series. Multiple wavelength light transmittance and light scattering techniques were used. Particle sizes were found to be .15 to .17 microns in the combustor, increasing in size to .35 to .45 microns in the aft can, and 1.5 to 1.6 microns at the exit of the augmentor tube. A MALVERN 2600 HSD particle sizer was used to verify the accuracy of the T-63 optical system. A number

of recommendations for improving the system were discussed.
GRA

N88-10035# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
INVESTIGATION OF THE EXCITATION OF TURBINE BLADE VIBRATION IN AXIAL COMPRESSORS IN ROTATING STALL Final Report [UNTERSUCHUNG DER SCHWINGUNGSERREGUNG VON LAUFSCHAUFELN IN AXIALVERDICHTERN BEI ROTATING STALL]
W. Moll Oct. 1986 64 p In GERMAN
(Contract DFG-KO-786/2-3-DER)
(ETN-87-90377) Avail: NTIS HC A04/MF A01

Measurements were performed on the seven-stage axial compressor of a gas turbine to study the characteristics of the rotating separation zones in the first stages and their effects on the production of vibrations. A contactless optoelectronic measuring system for rotating compressor turbines was developed. The unsteady flow quantities in the seven-stage compressor in rotating stall were determined using the split-film-probe measuring technique. A calculation model for the prediction of the compressor behavior in the first stage of the axial compressor was developed on the basis of a nonlinear theory. ESA

N88-10036# Technische Univ., Munich (West Germany). Fakultaet fuer Maschinenwesen.
CALCULATION OF THE DAMAGE OF HIGHLY LOADED GAS TURBINE DISKS UNDER REAL FLIGHT CONDITIONS Ph.D. Thesis [ZUR BERECHNUNG DER SCHAEDIGUNG HOCHBELASTETER FLUGGASTURBINEN-- SCHEIBEN UNTER REALEN FLUGBEDINGUNGEN]
Reinhard Hefele 1985 164 p In GERMAN
(ETN-87-90416) Avail: NTIS HC A08/MF A01

The typical loadings of motor rotor disks made of high temperature nickel alloys occurring during real flight missions were calculated. Stress and deformation calculations were performed using elastic and plastic constitutive laws and finite element methods. Irregular fatigue loadings were evaluated. Damage accumulation was calculated. The lifetime consumption per flight hour was determined from the calculated loadings using the nominal stress method; proposals for the improvement of this method are given. ESA

N88-10037# Technische Univ., Munich (West Germany). Fakultaet fuer Maschinewesen.
EXPERIMENTAL DETERMINATION OF THE OSCILLATORY FORCES ON TWO TURBINE BLADE PROFILES Ph.D. Thesis [EXPERIMENTELLE BESTIMMUNG DER SCHWINGUNGSERREGERKRAEFTE ZWEIER TURBINENSCHAUFELPROFILE]
Michael Hubensteiner 1986 151 p In GERMAN Sponsored by Deutschen Forschungsgemeinschaft, West Germany
(ETN-87-90417) Avail: NTIS HC A08/MF A01

The behavior of two 50%-reaction blades of different profile shape in the case of cascade interference under steady and unsteady flow was investigated in a cascade wind tunnel. The pressure distribution along the blade profiles was measured as a function of the relative position of the blades. The friction wake for both profiles was determined for different cascade distances. The unsteady pressure distribution on the blade profiles was measured in an air test turbine, and the oscillatory forces were deduced. The amplitude of the oscillation depends on the axial distance between the cascades, the velocity triangles in the stage, and the relative position of the blades in the neighboring oscillating cascade. Harmonics of the oscillatory forces were observed. The results show that production defects in the cascades can lead to significant unsteady forces on the blades. ESA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N88-10038# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
FLUTTER SUPPRESSION AND GUST LOAD ALLEVIATION. PART 1: RESULTS OF PHASE 1 TO 3. PART 2: DESCRIPTION OF THE GARTEUR MODEL
H. Hoenlinger, R. Manser, and D. Mussmann 20 Mar. 1985 64 p
(MBB-LKE292/S/PUB/191; ETN-87-90579) Copyright Avail: NTIS HC A04/MF A01

An adaptive flutter suppression system using target functions to adjust gain and phase of the control law was developed. The system was installed in a flutter model and tested successfully. The flutter speed can be increased 38%. A gust load alleviation system was developed and tested on the model. Flutter suppressor and gust load alleviation systems were combined and investigated under gusts. The wing root bending moment of the model can be decreased considerably. The model used for testing active control technology is described. It is a dynamically scaled subsonic model with hydraulically driven control surfaces. Basic geometry and mass data are given. The model instrumentation, model suspension, and wind tunnel test set up is explained. ESA

N88-10039*# Systems Technology, Inc., Hawthorne, Calif.
INVESTIGATION OF INTERACTIONS BETWEEN LIMB-MANIPULATOR DYNAMICS AND EFFECTIVE VEHICLE ROLL CONTROL CHARACTERISTICS Final Report
D. E. Johnston and D. T. McRuer Washington NASA May 1986 65 p Previously announced as N86-32991
(Contract NAS2-11454)
(NASA-CR-3983; H-1320; NAS 1.26:3983) Avail: NTIS HC A04/MF A01 CSCL 01C

A fixed-base simulation was performed to identify and quantify interactions between the pilot's hand/arm neuromuscular subsystem and such features of typical modern fighter aircraft roll rate command control system mechanization as: (1) force sensing side-stick type manipulator; (2) vehicle effective role time constant; and (3) flight control system effective time delay. The simulation results provide insight to high frequency pilot induced oscillations (PIO) (roll ratchet), low frequency PIO, and roll-to-right control and handling problems previously observed in experimental and production fly-by-wire control systems. The simulation configurations encompass and/or duplicate actual flight situations, reproduce control problems observed in flight, and validate the concept that the high frequency nuisance mode known as roll ratchet derives primarily from the pilot's neuromuscular subsystem. The simulations show that force-sensing side-stick manipulator force/displacement/command gradients, command prefilters, and flight control system time delays need to be carefully adjusted to minimize neuromuscular mode amplitude peaking (roll ratchet tendency) without restricting roll control bandwidth (with resulting sluggish or PIO prone control). Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N88-10040# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
REQUIREMENTS FOR A TEST STAND FOR PLASTIC ROLLERS FOR THE VERIFICATION OF NONEQUILIBRIUM FORCE LAWS [ANFORDERUNGEN AN EINEN PRUEFSTAND FUER KUNSTSTOFFROLLEN ZUR VERIFIZIERUNG INSTATIONAERER KRAFTSCHLUSSGESETZE]
Arnold Gross-Thebing Oct. 1986 57 p In GERMAN
(ILR-Mitt-176; ETN-87-90366) Avail: NTIS HC A04/MF A01

A friction test stand was designed for the investigation of the effect of high frequency vibrations of a vehicle wheel on the relation between contact forces and the relative velocity or slip of the rolling wheel. The basic concept of the test stand, the coordinate system for the study of the contact problem, the friction body, and the contact mechanics problem are outlined. The criteria for the construction of the test stand and for the materials choice are given. Experiments for the investigation of the force-slip relation are proposed. The theoretical and approximate formulas for the contact problem are given. ESA

N88-10041# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATION OF THE SUITABILITY OF THE 8FT X 6FT TRANSONIC WIND-TUNNEL FOR AEROACOUSTIC RESEARCH ON PROPELLERS
W. J. G. Trebble Jan. 1987 31 p
(RAE-TM-AERO-2093; BR102327; ETN-87-90697) Copyright Avail: NTIS HC A03/MF A01

The 8ft x 6ft transonic wind tunnel is shown to have a very high noise level, but near field noise signals from a 0.73 m diameter propeller are readily detected above the tunnel background noise at airspeeds up to at least Mach 0.6. Unfortunately the hard walls of the tunnel working chamber produce echoes which interfere with the propeller noise signals. For the facility to be used for aeroacoustic research it is necessary to either develop complex analytical methods using multiple microphone techniques or to line the interior walls of the working chamber with acoustic blankets. ESA

N88-10042# Los Alamos National Lab., N. Mex.
FAST SHOCK TUBE ASSEMBLIES
R. D. Steele and Tai-Ho Tan 1987 5 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-36)
(DE87-011732; LA-UR-87-2199; CONF-870753-16) Avail: NTIS HC A02

Developed are unique explosively driven devices to be used as fast-shock tubes or as particle launchers. Such drivers produce a highly symmetrical pressure wave that can be used to launch particles. Shocks in these devices of approximately 18 km/s have been achieved and there are plans to use these devices to accelerate particles in a shockless particle launch. DOE

N88-10043*# Texas Univ., Austin. Center for Electromechanics.
A FEASIBILITY STUDY OF A HYPERSONIC REAL-GAS FACILITY Final Report
J. H. Gully, M. D. Driga, and W. F. Weldon 26 Oct. 1987 154 p
(Grant NAG1-721)
(NASA-CR-180423; NAS 1.26:180423) Avail: NTIS HC A08/MF A01 CSCL 14B

A four month feasibility study of a hypersonic real-gas free flight test facility for NASA Langley Research Center (LARC) was performed. The feasibility of using a high-energy electromagnetic launcher (EML) to accelerate complex models (lifting and nonlifting) in the hypersonic, real-gas facility was examined. Issues addressed include: design and performance of the accelerator; design and performance of the power supply; design and operation of the sabot and payload during acceleration and separation; effects of high current, magnetic fields, temperature, and stress on the sabot and payload; and survivability of payload instrumentation during acceleration, flight, and soft catch. B.G.

N88-10044# Sandia National Labs., Albuquerque, N. Mex.
HIGH PRECISION ULTRASONIC SCANNING SYSTEM AND SAFT-UT DEVELOPMENT
W. W. Shurtleff Jun. 1987 12 p Presented at the JOWOG 39 NDE SUBWOG Meeting, Aldermaston, England, 1 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-010038; SAND-87-1319C; CONF-8706179-1) Avail: NTIS HC A03/MF A01

This paper describes a new ultrasonic testing system being developed in Albuquerque to provide precise scanning of smaller test objects. There are two major subsystems that make-up the ultrasonic testing system, a high precision scanner/digitizer and a real-time processing system which automates the synthetic aperture focusing technique. These subsystems are described in the following sections. DOE

N88-10045# Sandia National Labs., Albuquerque, N. Mex.
INSTRUMENTATION PACKAGE FOR A SHROUDED SWERVE/EPW ROCKET SLED TEST
E. G. Garavaglia Aug. 1987 42 p
(Contract DE-AC04-76DP-00789)
(DE87-014267; SAND-87-0984) Avail: NTIS HC A03/MF A01

A shrouded SWERVE test vehicle was instrumented and tested at MACH 3. The instrumentation consisted of accelerometers, pressure transducers, and event markers arranged in a nine-channel configuration. Data from the instrumentation were transmitted from the vehicle through an FM/FM telemetry system. Two fire sets and their associated command and controls were also included in this package. The event was recorded on high-speed color film, and the trajectory data were recorded by a laser tracker. DOE

N88-10046# Lawrence Livermore National Lab., Calif.
SHOCK-WAVE STUDIES USING PLASTIC FLYERS DRIVEN BY AN ELECTRIC GUN FOR HYPERVELOCITY IMPACT ON SELECTED MATERIALS
J. E. Osher, H. H. Chau, G. R. Gathers, R. S. Lee, G. W. Pomykal, and R. C. Weingart Jun. 1987 6 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-48)
(DE87-012631; UCRL-96498; CONF-870753-36) Avail: NTIS HC A02

The Lawrence Livermore National Laboratory (LLNL) electric gun is in use for a variety of shock-wave studies using plastic flyer impact on simple materials such as 6061-T6 Al and selected composite combinations at both normal and oblique incidence. The most commonly used flyer is 0.3-mm-thick Kapton at velocities from 1 to 18 mm/s. The experimentally measured wave shapes and attenuation are compared to code calculations, with particular interest in spall threshold and coupled momentum. DOE

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N88-10047*# McDonnell-Douglas Astronautics Co., Huntsville, Ala.
SPACE STATION MISSION PLANNING SYSTEM (MPS) DEVELOPMENT STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
W. J. Klus Mar. 1987 50 p
(Contract NAS8-37275)
(NASA-CR-179202; NAS 1.26:179202; MDC-W5108-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The basic objective of the Space Station (SS) Mission Planning System (MPS) Development Study was to define a baseline Space Station mission plan and the associated hardware and software requirements for the system. A detailed definition of the Spacelab (SL) payload mission planning process and SL Mission Integration Planning System (MIPS) software was derived. A baseline concept was developed for performing SS manned base payload mission planning, and it was consistent with current Space Station design/operations concepts and philosophies. The SS MPS software requirements were defined. Also, requirements for new software include candidate programs for the application of artificial intelligence techniques to capture and make more effective use of mission planning expertise. A SS MPS Software Development Plan was developed which phases efforts for the development software to implement the SS mission planning concept. B.G.

N88-10048*# McDonnell-Douglas Astronautics Co., Huntsville, Ala.
SPACE STATION MISSION PLANNING SYSTEM (MPS) DEVELOPMENT STUDY. VOLUME 2 Final Report
W. J. Klus Mar. 1987 348 p
(Contract NAS8-37275)
(NASA-CR-179200; NAS 1.26:179200; MDC-W5108-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 22A

The process and existing software used for Spacelab payload mission planning were studied. A complete baseline definition of the Spacelab payload mission planning process was established, along with a definition of existing software capabilities for potential extrapolation to the Space Station. This information was used as a basis for defining system requirements to support Space Station mission planning. The Space Station mission planning concept was reviewed for the purpose of identifying areas where artificial intelligence concepts might offer substantially improved capability. Three specific artificial intelligence concepts were to be investigated for applicability: natural language interfaces; expert systems; and automatic programming. The advantages and disadvantages of interfacing an artificial intelligence language with existing FORTRAN programs or of converting totally to a new programming language were identified. B.G.

N88-10049*# McDonnell-Douglas Astronautics Co., Huntsville, Ala.
SPACE STATION MISSION PLANNING STUDY (MPS) DEVELOPMENT STUDY. VOLUME 3: SOFTWARE DEVELOPMENT PLAN Final Report
W. L. Klus Mar. 1987 74 p
(Contract NAS8-37275)
(NASA-CR-179203; NAS 1.26:179203; MDC-W5108-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 22A

A software development plan is presented for the definition, design, and implementation of the Space Station (SS) Payload Mission Planning System (MPS). This plan is an evolving document and must be updated periodically as the SS design and operations concepts as well as the SS MPS concept evolve. The major segments of this plan are as follows: an overview of the SS MPS and a description of its required capabilities including the computer programs identified as configurable items with an explanation of the place and function of each within the system; an overview of the project plan and a detailed description of each development project activity breaking each into lower level tasks where applicable; identification of the resources required and recommendations for the manner in which they should be utilized including recommended schedules and estimated manpower requirements; and a description of the practices, standards, and techniques recommended for the SS MPS Software (SW) development. Author

N88-10050# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE
22 Apr. 1987 166 p Transl. into ENGLISH from various Russian articles
(JPRS-USP-87-003) Copyright Avail: NTIS HC A08/MF A01

Topics addressed include: manned mission highlights; space sciences; interplanetary sciences; space policy and administration; launch table; and space applications. For individual titles, see N88-10051 through N88-10055.

N88-10051# Joint Publications Research Service, Arlington, Va.
BLAGOV COMMENTARY ON MIR STATION, FIRST MANNING
V. D. Blagov *In its* USSR Report: Space 22 Apr. 1987 p 1-12 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 2-10 (For primary document see N88-10050 01-12)
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The Mir orbital station is the third generation of the Soviet orbital stations, on which complicated scientific and technical research and experiments were conducted in space for 15 years. The successful accomplishment of this complex flight demonstrated the high degree of reliability of Soviet space technology, of the methods for controlling the flight, the unlimited possibilities for further development and improvement, and for increasing the efficiency of scientific research. The launch of the Mir station laid the foundation for the establishment in orbit of permanently active, manned scientific research complexes. Scientific research on the Earth's natural resources and on astrophysical objects, as well as medicine and biology will assume permanency. The production of alloys and crystals, medicines free from allergens, and various biological preparations will gradually reach an industrial scale. The orbital complexes will consist of a large number of modules including ones flying apart from the base block and space tugs will make flights between the modules to service them. B.G.

N88-10052# Joint Publications Research Service, Arlington, Va.
X-RAY ASTRONOMY INSTRUMENTS TO OPERATE ON MIR STATION **c89**
Tamara Breus *In its* USSR Report: Space 22 Apr. 1987 p 50-51 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 21, 5 Nov. 1986 p 1-3 (For primary document see N88-10050 01-12)
Copyright Avail: NTIS HC A08/MF A01

The Soviet Salyut orbital stations were the first to carry X-ray telescopes into space. The Mir station offers still greater opportunities for astronomical observations by ensuring high guidance accuracy in the automatic regime. Even more important, it extends the period of observations without impairing other research programs. The X-ray telescopes will operate within a wide band of energies, making it possible to solve in principle astrophysical tasks unattainable for the available space-based telescopes. Equipment and instruments for the Mir X-ray observatory were developed and manufactured through the collective efforts of the Soviet Union, the Netherlands, West Germany, and the European Space Agency. The design and advantages of the telescope are discussed. B.G.

N88-10053# Joint Publications Research Service, Arlington, Va.
FINAL PHASE OF PROJECT VEGA
V. M. Balebanov *In its* USSR Report: Space 22 Apr. 1987 p 62-74 Transl. into ENGLISH from Sovremennyye Dostizheniya Kosmonavtiki (Novoye v Zhizni, Nauke, Tekhnike: Seriya Kosmonavtika, Astronomiya) (Moscow, USSR), no. 12, Dec. 1986 p 17-34 (For primary document see N88-10050 01-12)
Copyright Avail: NTIS HC A08/MF A01

The Vega Project is one of the most complex projects for research on the solar system by means of spacecraft. It consisted of three parts: research on the atmosphere and surface of Venus by means of descent space vehicles; studies of the dynamics of the atmosphere of Venus by means of aerostat sondes; and flying through the gas-and-dust atmosphere (coma) and plasma envelope of Halley's comet while making an extensive set of studies. Each topic is discussed along with its instrumentation, goals, and data. B.G.

N88-10054# Joint Publications Research Service, Arlington, Va.
VENUSIAN SURFACE AND CRUST **c91**
V. L. Barsukov and Yu. A. Surkov *In its* USSR Report: Space 22 Apr. 1987 p 75-91 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 3-15 (For primary document see N88-10050 01-12)
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As is well known, the flights of spacecraft to Venus and investigations of Venus from the Earth's surface have made it possible to develop concepts concerning its surface and rocks (composition, structure, and properties). These ideas are based primarily on four panoramic images of the surface and investigation of the elemental composition and physical characteristics of rocks in seven regions of station landings. In addition, definite information on the rocks was obtained on the basis of composition of the near-surface atmosphere and also on the basis of the physical and climatic conditions near the surface. Finally, an important contribution was made by radar studies of macroscale geological structures. During the last two decades all this has made possible a considerable broadening of concepts concerning the Venusian surface and crust, despite the thick atmosphere, dense cloud cover, and severe climatic conditions on the planet. Author

N88-10055# Joint Publications Research Service, Arlington, Va.
STUDY OF EARTH FROM SPACE AND STRENGTHENING OF ECONOMY **c43**
Yu. P. Kiyenko *In its* USSR Report: Space 22 Apr. 1987 p 115-126 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 16-25 (For primary document see N88-10050 01-12)
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Under modern conditions of development of the economy appropriate attention must be directed to mobilization of natural production forces. For this reason there was an increase, in particular, of the role of remote sensing of the Earth from space. What the advantages are of space information over the data obtained by traditional methods are discussed. Today the elements of the space system for the study of natural resources and the environment are being used in the interests of the development of the national economy, but also within the framework of international cooperation. Certification and realization of a comprehensive inventory of the natural potential of the entire country should become an important contribution of the study of the Earth from space to the development of the economy. By such an inventory and regularly repeated space surveys in the immediate future it may be possible, first of all, to organize monitoring of the dynamics of natural processes, and second, to ensure the setting up of an automated system for control of the use of natural resources. B.G.

N88-10056# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung HF-Verfahren.
PLANNING AND EXECUTION OF THE NAVEX EXPERIMENT IN THE SPACELAB MISSION D1
Siegfried Starker, Hartmut Nau, and Jens Hammesfahr Nov. 1986 120 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-1078)
(DFVLR-FB-87-03; ISSN-0171-1342; ETN-87-90450) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany DM 37

The conception and the arrangement of the navigation experiment NAVEX, as well as the preparations and operations during the German Spacelab mission D1 are described. The main purpose of NAVEX was the realization and testing of techniques for the functions of future satellites and ground stations in navigation and timing systems using precise frequency standards. Mathematical descriptions of the experiments are explained. The data acquisition and processing systems are outlined. Results show that the techniques are successful, and that the measuring methods are well suited for timing systems. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N88-10057# Technische Univ., Hanover (West Germany). Fachbereich Bauingenieur- und Vermessungswesen.
THE SEQUENTIAL EVALUATION OF DOPPLER SATELLITE OBSERVATIONS Ph.D. Thesis [ZUR SEQUENTIELLEN AUSWERTUNG VON DOPPLER-SATELLITENBEOBACHTUNGEN]
Delf Egge 1985 158 p In GERMAN
(Rept-141; ISSN-0174-1454; ETN-87-90381) Avail: NTIS HC A08/MF A01

Evaluation models for Doppler satellite observations, that contain the full geodetic accuracy potential and can easily be applied to moving receiver antennas were investigated. Integrated Doppler counts (the primary observation quantities in the TRANSIT satellite system) were sequentially evaluated using Kalman filter methods. The Kalman form of parameter updating was used as an alternative to normal-equation-oriented algorithms. The application of Kalman filter methods for the determination of time dependent state variables was analyzed, and concepts for programming for positioning with Doppler satellite methods were developed. The off-line programming system is shown to be very flexible. The on-line system consists essentially of real time programs, and does not require majority voting and polynomial representation of the satellite orbit. ESA

N88-10058# Royal Aircraft Establishment, Farnborough (England).
THE CONTRACTION OF SATELLITE ORBITS UNDER THE INFLUENCE OF AIR DRAG. PART 8: ORBITAL LIFETIME IN AN OBLATE ATMOSPHERE, WHEN PERIGEE DISTANCE IS PERTURBED BY ODD ZONAL HARMONICS IN THE GEOPOTENTIAL
D. G. King-Hele and Doreen M. C. Walker Nov. 1986 41 p
(RAE-TR-86069-Pt-8; RAE-Space-667-Pt-8; BR102274;
ETN-87-90700) Copyright Avail: NTIS HC A03/MF A01

This report is devoted to developing the necessary orbital theory for predicting the lifetimes of satellites moving in an oblate atmosphere and subjected to the perturbations due to odd zonal harmonics in the geopotential. The effects of odd zonal harmonics and atmospheric oblateness are expressed as multiplying factors, F(oz) and F(ao), to be applied to the lifetime predictions calculted in the absence of the perturbations. The results are valid for the great majority of orbits about the Earth, and in particular for all orbital eccentricities between 0 and 1; but the limits set for the controlling parameters exclude (a) near-polar orbits with perigee heights lower than about 180 km, and (b) orbits having inclinations within a narrow band centred on 63.4 deg. The results show that, when the controlling parameters are at their upper limits, either F(oz) or F(ao) can change the lifetime by up to about 35%, and taken together they can produce changes of up to 60%, if the initial and final positions of perigee are at specified points on the orbit and the eccentricity exceeds 0.2. Such combinations of values rarely arise, however, and the effects are more often on the order of 10-20%. Even at these moderate levels, the effects need to be taken into account in order to make realistic estimates of the decay dates of satellites in the last few months of their lives. ESA

N88-10059# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
A STUDY OF A SATELLITE-TO-SATELLITE TRACKING CONFIGURATION BY APPLICATION OF LINEAR PERTURBATION THEORY
E. Schrama Nov. 1986 45 p Sponsored by the Netherlands Organization for the Advancement of Pure Research
(Rept-86.3; B8709235; ETN-87-90833) Avail: NTIS HC A03/MF A01

Two methods with which the satellite-to-satellite tracking (SST) observable frequency spectrum can be related to potential coefficients were tested. The first model, a direct relation between the observation equation and the unknown potential coefficients, is impractical. The second method shows that the coefficients can in principle be reordered per equal order which results in a block diagonal system of normal equations. The problems of computing inclination functions, which are essential in applying the linear perturbation theory, are discussed. The fast numerical method described by Wagner (1980) provides all inclination functions up to high degree and order. The attenuation of the high degree harmonics is inverse proportional to the separation distance. The SST range rate attenuation of wavelengths in the gravity field coincides with the separation distance. ESA

N88-10060# Uppsala Univ. (Sweden). Ionospheric Observatory.
SATELLITE ORBITS: PLOT ROUTINES M.S. Thesis
Pelle Olsson Feb. 1987 72 p
(UIO-SR-87-02; ISSN-0349-2699; ETN-87-90741) Avail: NTIS HC A04/MF A01

Routines for plotting satellite orbits for the Waves in Space Plasmas shuttle-borne experiment are presented. The principles of virtual device coordinate text are outlined. The programs are written in C language on the HP-UX operating system and the Starbase graphics package. ESA

N88-10636# Barcelona Univ. (Spain).
RELATIVE MOTION NEAR THE TRIANGULAR LIBRATION POINTS IN THE EARTH-MOON SYSTEM
C. Simo, R. Martinez, G. Gomez, J. Llibre, W. Flury, and J. Rodriguez-Canabal (European Space Agency. European Space Operations Center, Darmstadt, West Germany) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 157-170 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N88-10061# Los Alamos National Lab., N. Mex.
NUMERICAL PREDICTIONS OF EML SYSTEM PERFORMANCE
N. M. Schnurr, J. F. Kerrisk, and R. F. Davidson 1987 18 p Presented at the 5th US Army Symposium on Gun Dynamics, Rensselaerville, N.Y., 23 Sep. 1987
(Contract W-7405-eng-36)
(DE87-011727; LA-UR-87-2251; CONF-8709109-1) Avail: NTIS HC A03/MF A01

The performance of an electromagnetic launcher (EML) depends on a large number of parameters, including the characteristics of the power supply, rail geometry, rail and insulator material properties, injection velocity, and projectile mass. EML system performance is frequently limited by structural or thermal effects in the launcher (railgun). A series of computer codes has been developed at the Los Alamos National Laboratory to predict EML system performance and to determine the structural and thermal constraints on barrel design. These codes include FLD, a two-dimensional electrostatic code used to calculate the high-frequency inductance gradient and surface current density distribution for the rails; TOPAZRG, a two-dimensional finite-element code that simultaneously analyzes thermal and electromagnetic diffusion in the rails; and LARGE, a code that predicts the performance of the entire EML system. The NIKE2D code, developed at the Lawrence Livermore National Laboratory, is used to perform structural analyses of the rails. These codes have been instrumental in the design of the Lethality Test System at Los Alamos, which has an ultimate goal of accelerating a 30-g projectile to a velocity of 15 km/s. The capabilities of the individual codes and the coupling of these codes to perform a comprehensive analysis is discussed in relation to the LTS design. Numerical predictions are compared with experimental data and presented for the LTS prototype tests. DOE

N88-10062# Los Alamos National Lab., N. Mex.
SWITCHING DEVICES USED IN THE LETHALITY TEST SYSTEM
W. M. Parsons, R. D. Ford, P. Wildi, and P. Chowdhuri 1987 6 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987 Prepared in cooperation with Naval Research Lab., Washington, D.C., Texas Univ., Austin and Tennessee Technological Univ., Cookeville
(Contract W-7405-eng-36)
(DE87-011734; LA-UR-87-2192; CONF-870656-34) Avail: NTIS HC A02

The Lethality Test System (LTS) is an experiment which will utilize a light gas gun-railgun combination to accelerate projectiles for impact studies. The power supply for the railgun consists of an 80 MJ (kinetic) generator-flywheel array used to charge the primary windings of three cryogenic pulse transformers. The secondary windings of these transformers will supply up to 50 MJ of electrical energy to the railgun. A number of special switching devices will be required to cause energy transfer and compression. This paper describes the design and testing of these switching devices. DOE

N88-10063# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
EXACT SOLUTIONS TO THE GOVERNING DYNAMIC EQUATIONS OF PLASMA ARMATURE ELECTROMAGNETIC RAILGUNS
M. Shahinpoor and R. S. Hawke Aug. 1987 27 p Prepared in cooperation with Lawrence Livermore National Lab., Calif. and Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE87-014442; SAND-87-0473) Avail: NTIS HC A03/MF A01

General governing nonlinear differential equations pertaining to the dynamic behavior of a plasma armature electromagnetic railgun are first derived. Three different cases are then considered and the corresponding governing equations are then solved exactly by means of a set of nonlinear transformations. These cases correspond to: (1) no-ablation, (2) continuous-ablation, and (3) partial-ablation for which an ablation threshold velocity nu(sub t) plays a fundamental role. Corresponding to each case, a nonlinear transformation is employed to reduce the nonlinear differential equations to their equivalent linear ones and subsequently allow solution of the pertinent linear differential equations, which are second order, by means of the transition matrix technique. It is concluded that in order to achieve very high projectile velocities the projectile should be injected into the railgun at velocities higher than the ablation threshold velocity. Thus, the ablation may be completely alleviated and the ensuing turbulent drag may be significantly diminished. It is shown that under these conditions one may typically accelerate projectiles up to 30 km/s or more while without hypervelocity injection, for the same railgun and typical operating conditions, one might severely limit the maximum projectile velocity. DOE

N88-10064# Selenia Industrie Associate S.p.A., Rome (Italy). Education and Training Dept.
RIVISTA TECNICA SELENIA, VOLUME 10, NUMBER 2

Adriana Marzi, ed. 1986 48 p
(ETN-87-90763) Copyright Avail: NTIS HC A03/MF A01

Importance sampling and its application to radar simulation; optimum dimensioning of field service centers; automatic test facilities; and the Ariane telemetry conditioning units are discussed. For individual titles, see N88-10065 through N88-10068.

N88-10065# Selenia Industrie Associate S.p.A., Rome (Italy).
THE IMPORTANCE SAMPLING AND ITS APPLICATION TO RADAR SIMULATION
Antonio DiVito and Gaspare Galati *In its* Rivista Tecnica Selenia, Volume 10, Number 2 1986 p 1-12 (For primary document see N88-10064 01-14)
Copyright Avail: NTIS HC A03/MF A01

Importance sampling techniques to reduce the estimate variance in Monte Carlo simulations is introduced. The problem of estimating the false alarm probability of a radar detector is considered. The importance sampling technique achieves a variance reduction which corresponds to a reduction of number of tests of a factor typically between 10 and 1000, although there is no upper boundary. For an effective utilization of the technique in subject, random generation must be adapted to the particular problem, for which there are no direct criteria available. The criterion usually adopted in the application shown is to increase the noise power in the problems connected to the estimate of the number of false alarms; however, better performance can be obtained with criteria which are more sophisticated and more tightly connected to the particular problem. ESA

N88-10066# Selenia Industrie Associate S.p.A., Rome (Italy). ITC Div.
OPTIMUM DIMENSIONING OF FIELD SERVICE CENTERS: ANALYSIS OF THE PROBLEM AND SOLUTIONS THEREOF
Giuseppe Lombardi, Lamberto Pescatori, and Giuseppe Rosato *In its* Rivista Tecnica Selenia, Volume 10, Number 2 1986 p 13-23 (For primary document see N88-10064 01-14)
Copyright Avail: NTIS HC A03/MF A01

The development problem connected to the dimensioning of a field service center (FSC) is analyzed. General considerations made on an FSC organizational structure are such that the development problem may fit queue theory; analysis is based upon the simulation tool Q-GERT. Starting from a typical FSC structure, Q-GERT modeling is considered and a solution to the dimensioning problem by exploiting the successive approximations technique is shown. ESA

N88-10067# Selenia Industrie Associate S.p.A., Rome (Italy). Aircraft Support Systems Dept.
THE ISA TEST SYSTEM: A CATALOG OF AUTOMATIC SUPPORT FACILITIES
Silvino DErcole *In its* Rivista Tecnica Selenia, Volume 10, Number 2 1986 p 24-29 (For primary document see N88-10064 01-14)
Copyright Avail: NTIS HC A03/MF A01

Modular automatic test equipment (MATE) architecture for standardization of field support of avionics units and systems was developed. The MATE architecture is described. The ISA general purpose test system is presented. Application of ISA to an airborne electronic warfare system is shown. ESA

N88-10068# Selenia Industrie Associate S.p.A., Rome (Italy).
TELEMETRY CONDITIONING UNITS FOR THE EUROPEAN LAUNCHER ARIANE
Guido Meneghini *In its* Rivista Tecnica Selenia, Volume 10, Number 2 1986 p 30-43 (For primary document see N88-10064 01-14)
Copyright Avail: NTIS HC A03/MF A01

The components and functions of the Ariane telemetry conditioning units (TCU) are discussed. The TCU functions comprise transducing into voltage levels of the temperature, pressure, etc, transducer parameters; supplying current or voltage to sensors; and signal amplification. The dc/dc converter, Wheatstone and Kelvin bridges, power supply, constant current generator, amplifier, energy measurement, and packaging are described. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

No abstracts in this category.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N88-10069# Bonn Univ. (West Germany). Fakultaet fuer Naturwissenschaftlichten.
THE COMPOSITION OF THE GAS IN THE LOADING INLET OF THE SPACE SHUTTLE ORBITER Ph.D. Thesis [DIE ZUSAMMENSETZUNG DES GASES IN DER LADEBUCHT DES SPACE-SHUTTLE-ORBITERS]
Eckart Wulf 1986 135 p In GERMAN
(Contract BMFT-01-QV-239)
(ETN-87-90430) Avail: NTIS HC A07/MF A01

The double-focussing, magnetic mass spectrometer BNMS was used during the Space Shuttle missions 7 and 41-B to investigate the gas composition in the payload inlet and the close environment of the orbiter. A continuous mass spectrum was determined in a large mass range, and trace gases in the orbiter contamination cloud were identified. The spectrometer allowed the distinction between direct particle fluxes from Orbiter surfaces and those from outside in the payload inlet. The neutral gas composition in the payload inlet under different observation conditions, the effects of ignition of the Orbiter position control drives, and the interaction of atmospheric gases with surfaces were determined. ESA

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N88-10096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELEMETRY, TRACKING, AND CONTROL WORKING GROUP REPORT
Richard Campbell and L. Joseph Rogers *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 165-175 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N88-10070*# Boeing Aerospace Co., Seattle, Wash.
SPACE STATION INTEGRATED WALL DESIGN AND PENETRATION DAMAGE CONTROL
A. R. Coronado, M. N. Gibbins, M. A. Wright, and P. H. Stern Jul. 1987 312 p
(Contract NAS8-36426)
(NASA-CR-179169; NAS 1.26:179169; D180-30550-4) Avail: NTIS HC A14/MF A01 CSCL 22B

The analysis code BUMPER executes a numerical solution to the problem of calculating the probability of no penetration (PNP) of a spacecraft subject to man-made orbital debris or meteoroid impact. The codes were developed on a DEC VAX 11/780 computer that uses the Virtual Memory System (VMS) operating system, which is written in FORTRAN 77 with no VAX extensions. To help illustrate the steps involved, a single sample analysis is performed. The example used is the space station reference configuration. The finite element model (FEM) of this configuration is relatively complex but demonstrates many BUMPER features. The computer tools and guidelines are described for constructing a FEM for the space station under consideration. The methods used to analyze the sensitivity of PNP to variations in design, are described. Ways are suggested for developing contour plots of the sensitivity study data. Additional BUMPER analysis examples are provided, including FEMs, command inputs, and data outputs. The mathematical theory used as the basis for the code is described, and illustrates the data flow within the analysis. B.G.

N88-10071*# Martin Marietta Corp., Denver, Colo.
TELEPRESENCE WORK STATION SYSTEM DEFINITION STUDY, PART 2 Final Report
May 1987 65 p
(Contract NAS9-17230)
(NASA-CR-172006; NAS 1.26:172006; MCR-86-528) Avail: NTIS HC A04/MF A01 CSCL 22B

This study effort has shown that the development of a space robotic servicing system is totally feasible. More importantly, many of the key elements of such a system are currently available as the result of previous and ongoing technical efforts. In many cases, decisions remain to be made concerning tradeoffs between options available to satisfy system technology requirements. The primary recommendation resulting from this study is for the development of a flight test bed system that could be used to establish a performance database to assist some of the necessary technical decisions described in the study package. A properly design flight test bed system would prove tremendously useful in terms of rapidly evaluating technology in a realistic setting and would be a great benefit in the development of the operational system.
Author

N88-10072*# National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION: LEADERSHIP FOR THE FUTURE
Franklin D. Martin and Terence T. Finn 1987 10 p Original contains color illustrations
(NASA-PAM-509/8-87) Avail: NTIS HC A02/MF A01 CSCL 22B

No longer limited to occasional spectaculars, space has become an essential, almost commonplace dimension of national life. Among other things, space is an arena of competition with our allies and adversaries, a place of business, a field of research, and an avenue of cooperation with our allies. The space station will play a critical role in each of these endeavors. Perhaps the most significant feature of the space station, essential to its utility for science, commerce, and technology, is the permanent nature of its crew. The space station will build upon the tradition of employing new capabilities to explore further and question deeper, and by providing a permanent presence, the station should significantly increase the opportunities for conducting research in space. Economic productivity is, in part, a function of technical innovation. A major thrust of the station design effort is devoted to enhancing performance through advanced technology. The space station represents the commitment of the United States to a future in space. Perhaps most importantly, as recovery from the loss of Challenger and its crew continues, the space station symbolizes the national determination to remain undeterred by tragedy and to continue exploring the frontiers of space. B.G.

N88-10073# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
STUDY OF ADVANCED SATELLITE CONCEPT USING A MULTIFEED RECONFIGURABLE ANTENNA Final Report
E. Frisch, H. J. Steiner, N. Schroeder, R. King, C. Carnebianca, R. Capone, P. Palmucci, and R. Trotta (Italspazio, Rome, Italy) Paris, France ESA Dec. 1986 184 p
(Contract ESTEC-6165/85-F-RD(SC))
(ESA-CR(P)-2406-Vol-1; ETN-87-90540) Avail: NTIS HC A09/MF A01

Towerless single and dual reflector antennas with 2.5 to 3.5 m circular aperture are studied for use on board medium-size geostationary communication satellites (up to 2 tons in transfer orbit) to be launched in Ariane 4 bottom position, SPELDA 10, on the basis of a typical mission of trunk telephony and TV distribution in the 11/14 GHz range requiring multispot beam and various contour beams European area coverages. The total coverage range is +/- 4 deg E-W, +/- 2.5 deg N-S with extensive frequency reuse and extreme cross-polar purity (33 dB). It is shown that the best candidate is a PSR offset parabolic antenna, one for Tx and for Rx each, operating with a boresight spot edge taper of 18 dB, the Tx aperture being 2.86 m, Rx 2.25 m, each antenna with a feed system for each of the orthogonal polarizations (one for the spot beams and the other for the contoured beams). The second best antenna is a special design of the front-fed Cassegrain.
ESA

N88-10074# Italspazio, Rome (Italy).
STUDY OF ADVANCED SATELLITE CONCEPT USING A MULTIFEED RECONFIGURABLE ANTENNA. DETAILED REPORT ON MISSION DEFINITION, COVERAGE ANALYSIS AND PERFORMANCE REQUIREMENTS, ANTENNA GEOMETRY Final Report
Paris, France ESA 11 Nov. 1985 276 p
(Contracts ESTEC-6165/85-F-RD(SC); R-2298/32-89-R)
(ITS-TR-014.C/85; ESA-CR(P)-2406-Vol-2; ETN-87-90541)
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Towerless single and dual reflector antennas with 2.5 to 3.5 m circular aperture were studied for use on board medium-size geostationary communication satellites (up to 2 tons in transfer orbit) to be launched in Ariane 4 bottom position, SPELDA 10, on the basis of a typical future mission of trunk telephony and TV distribution in the 11/14 GHz range requiring multispot beam and various contour beams European area coverages. Transponder requirements, payload outline, link budgets, and antenna performance specifications are presented. ESA

N88-10075# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
STUDY OF ADVANCED SATELLITE CONCEPT USING A MULTIFEED RECONFIGURABLE ANTENNA. DETAILED REPORT ON POLARIZATION SENSITIVE REFLECTOR (PSR) AND OFFSET PARABOLIC ANTENNAS, APPENDIX 1 Final Report
Paris, France ESA Dec. 1986 189 p
(Contract ESTEC-6165/85-F-RD(SC))
(ESA-CR(P)-2406-Vol-3; ETN-87-90542) Avail: NTIS HC A09/MF A01

Three polarization sensitive and solid single offset reflector antennas were analyzed. The design of gridded reflectors and dielectrical sandwich structure between polarization sensitive reflectors is discussed, and the reflection coefficients are computed. The possibility of having one antenna for both transmit and receive band is considered. The chosen antenna is a polarization sensitive reflector antenna with an F/D-ratio of 1.2; the reflector aperture is 2.5 m. The advantage of the polarization sensitive reflector antennas is the possibility of having two different feed clusters with orthogonal polarization, so that one feed cluster can be used for multibeam application, while the second feed cluster is used for contoured beams. ESA

N88-10076# Italspazio, Rome (Italy).
STUDY OF ADVANCED SATELLITE CONCEPT USING A MULTIFEED RECONFIGURABLE ANTENNA. APPENDIX 3 : FEEDING NETWORK, FINAL PERFORMANCE ANALYSIS, STUDY OF RECONFIGURATION POSSIBILITIES Final Report
Paris, France ESA Feb. 1986 138 p
(Contracts ESA-6165/85-F-RD(SC); R-2298/3298-R)
(ITS-TR-032/85; ESA-CR(P)-2406-Vol-4; ETN-87-90543)
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Towerless single and dual reflector antennas with 2.5 to 3.5 m circular aperture were studied for use on board medium-size geostationary communication satellites (up to 2 tons in transfer orbit) to be launched in Ariane 4 bottom position, SPELDA 10, on the basis of a typical future mission of trunk telephony and TV distribution in the 11/14 GHz range requiring multispot beam and various contour beams European area coverages. Beam forming networks, systems performance, and reconfiguration are discussed. ESA

N88-10077# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Experimental Fluid Mechanics.
ANALYSIS OF FREE MOLECULAR EFFECTS ON THE ATTITUDE OF SATELLITES IN GEOSTATIONARY TRANSFER ORBIT. PART 1: THEORETICAL ANALYSIS
R.-D. Boettcher Paris, France ESA 1986 115 p
(Contract ESOC-5762/83-D-IM(SC))
(DFVLR-IB-222-86-A-08; ESA-CR(P)-2408-Vol-1; ETN-87-90544)
Avail: NTIS HC A06/MF A01

A computer program was developed for spin stabilized satellites to calculate aerodynamics-induced attitude changes, using free molecular flow theory and a modified exponential atmospheric density law. The geometry approximation by plane elements allows convex or concave shapes. The latter are treated by a simplified flow model restricted to mutual surface shadowing, neglecting multiple wall collisions of molecules. The ECS, MARECS, and Meteosat satellites illustrate program application. Comparisons with MARECS inflight data and an alternate theoretical approach show satisfactory agreement. ESA

N88-10078# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Experimental Fluid Mechanics.
ANALYSIS OF FREE MOLECULAR EFFECTS ON THE ATTITUDE OF SATELLITES IN GEOSTATIONARY TRANSFER ORBIT. PART 2: FORCE AND TORQUE MEASUREMENT IN FREE MOLECULAR WIND TUNNEL TESTS
G. Koppenwallner and H. Legge Paris, France ESA 1986 50 p
(Contract ESOC-5762/83-D-IM(SC))
(DFVLR-IB-222-86-A-07; ESA-CR(P)-2408-Vol-2; ETN-87-90545)
Avail: NTIS HC A03/MF A01

In order to determine the center of pressure of a satellite in addition to lift, drag, and moment coefficients, the feasibility of combined force and torque measurements in free molecular wind tunnel experiments is analyzed. An electromagnetic two-component balance seems suitable for this task. ESA

N88-10079# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF A PAYLOAD FOR COLUMBUS POLAR PLATFORM EARTH OBSERVATION DEMONSTRATION MISSION, EXECUTIVE SUMMARY
A. Hamesfahr, M. Langemann, J. E. Charlton, R. Cortinovis, F. G. Sawyer, P. Hollier (MATRA Espace, Toulouse, France), and N. Skou Paris, France ESA Sep. 1986 31 p
(Contract ESTEC-6612/86-NL-JS)
(ESA-CR(P)-2412; ETN-87-90548) Avail: NTIS HC A03/MF A01

A set of six core instruments was defined for the IOC model payload of the Columbus Morning Polar Platform. The synthetic aperture radar, the optical imager, the multifrequency imaging microwave radiometer, and the wind scatterometer were studied. The definition status of the instruments with respect to their basic electrical and mechanical design features, performance, resource requirements, mutual compatibilities, and their adaptability on the Columbus platform is summarized. ESA

N88-10080# Aeritalia S.p.A., Naples (Italy). Gruppo Sistemi Spaziale.
COLUMBUS PREPARATORY PROGRAM. PAYLOAD ELEMENT STUDY ON A TECHNOLOGY DEMONSTRATION MISSION, EXECUTIVE SUMMARY
F. Borlasia, F. Giani, R. Sock, H. Friederich, T. Wierenga, and J. Pairot (MATRA Espace, Paris-Velizy, France) Paris, France ESA 15 Dec. 1986 77 p
(Contract ESA-6614/85-NL-PP(SC))
(CS-RP-AI-016; ESA-CR(P)-2401; ETN-87-90556) Avail: NTIS HC A05/MF A01

The review, further definition, and preliminary conceptual design of four technology demonstration model missions for possible performance on the Columbus module of the United States Space Station are summarized. Guidelines for potential users and the Columbus study team concerning the design of cost effective and user friendly space infrastructure for technology missions are given. The four technology model missions investigated were: Robotic Servicing Experiment; Fluid Transfer Management System; Large Structure Deployment/Assembly; and Tether System. Two additional concepts were selected by ESA for consideration: European Space Technology Exposure Facility and Technology Workbench. ESA

N88-10081# European Space Agency, Paris (France). Space Science Dept.
REPORT ON THE SCIENTIFIC SATELLITES OF THE EUROPEAN SPACE AGENCY
W. R. Burke, ed., Brian G. Taylor, ed., U. O. Frisk, R. Grard, P. Jakobsen, M. Kessler, J.-P. Lebreton, R. Marsden, H. Olthof, and A. Peacock (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) et al. May 1987 155 p Original contains color illustrations
(ESA-SP-1090; ISSN-0379-6566; ETN-87-90868) Copyright Avail: NTIS HC A08/MF A01

The status of the ISEE, IUE, EXOSAT, Spacelab, and Giotto missions is described. The Ulysses, Hubble Space Telescope, HIPPARCOS, ISO, EURECA, and Cluster/SOHO projects are discussed. The submillimeter mission, high throughput X-ray spectroscopy mission, and the comet nucleus sample return mission are introduced. The Lyman, Quasat, and Cassini studies are summarized. The GRASP gamma ray astronomy mission, the Vesta Mars mission, and the Giotto extended mission are reviewed. ESA

N88-10082*# North Carolina Univ., Charlotte. Dept. of Electrical Engineering.
DYNAMICS OF SPACECRAFT CONTROL LABORATORY EXPERIMENT (SCOLE) SLEW MANEUVERS Interim Report
Y. P. Kakad Washington NASA Oct. 1987 43 p
(Grant NAG1-535)
(NASA-CR-4098; NAS 1.26:4098) Avail: NTIS HC A03/MF A01 CSCL 22B

This is the first of two reports on the dynamics and control of slewing maneuvers of the NASA Spacecraft Control Laboratory Experiment (SCOLE). In this report, the dynamics of slewing maneuvers of SCOLE are developed in terms of an arbitrary maneuver about any given axis. The set of dynamical equations incorporate rigid-body slew maneuver and three-dimensional vibrations of the complete assembly comprising the rigid shuttle, the flexible beam, and the reflector with an offset mass. The analysis also includes kinematic nonlinearities of the entire assembly during the maneuver and the dynamics of the interaction between the rigid shuttle and the flexible appendage. The final set of dynamical equations obtained for slewing maneuvers is highly nonlinear and coupled in terms of the flexible modes and the rigid-body modes. The equations are further simplified and evaluated numerically to include the first ten flexible modes and the SCOLE data to yield a model for designing control systems to perform slew maneuvers. Author

N88-10083# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environmental Lab.
TIROS-N/NOAA A-J SPACE ENVIRONMENT MONITOR SUBSYSTEM
R. A. Seale and R. H. Bushnell Apr. 1987 117 p
(PB87-203998; NOAA-TM-ERL-SEL-75) Avail: NTIS HC A06/MF A01 CSCL 22B

The Space Environment Monitor (SEM), which is incorporated as a subsystem in the TIROS-N and NOAA A-J satellites, is described. The SEM consists of a Total Energy Detector (TED), a Medium Energy Proton and Electron Detector (MEPED), a High Energy Proton and Alpha Detector (HEPAD), and a Data Processing Unit (DPU). The detectors are intended to provide near real time particle data for use in the Space Environment Service Center of National Oceanic and Atmospheric Administration (NOAA), and to provide a long term scientific data base. Telemeter codes, data reduction, and test instructions are given. GRA

N88-10084*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACECRAFT 2000
Jul. 1986 236 p Workshop held in Cleveland, Ohio, 29-31 Jul. 1986
(NASA-CP-2473; E-3358; NAS 1.55:2473) Avail: NTIS HC A11/MF A01 CSCL 22B

The objective of the Workshop was to focus on the key technology area for 21st century spacecraft and the programs needed to facilitate technology development and validation. Topics addressed include: spacecraft systems; system development; structures and materials; thermal control; electrical power; telemetry, tracking, and control; data management; propulsion; and attitude control. For individual titles, see N88-10085 through N88-10100.

N88-10085*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACECRAFT 2000 PROGRAM OVERVIEW
Robert W. Bercaw *In its* Spacecraft 2000 Jul. 1986 p 1-6 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The goals are to identify the critical need and technologies for spacecraft of the 21st century, and to recommend technology development and validation programs and possible government/industrial roles and partnerships. The objectives of the workshop are to increase awareness and exchange ideas among participants, highlight the spacecraft as a focal point for technology, and facilitate industry-government coordination. B.G.

N88-10086*# General Electric Co., Philadelphia, Pa.
SPACE STATION PLATFORMS
Daniel F. Reid *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 7-10 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The international space station platforms are the first step toward routine application of special features. Growth capabilities and expansion of technology are examined. Resource requirements, servicing, modularity, and autonomous operations are outlined. B.G.

N88-10087*# Department of the Air Force, Andrews AFB, Md.
MILITARY NEEDS AND FORECAST, 2 c85
Alan B. Goldstayn *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 11-25 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 12B

FORECAST 2 has accomplished its objectives of identifying high leverage technologies for corporate Air Force review. Implementation is underway with emphasis on restructuring existing programs and programming resources in the FY88 BES/FY89 POM. Many joint service/agency opportunities exist. Author

N88-10088*# National Aeronautics and Space Administration, Washington, D.C.
COMMUNICATION SATELLITE TECHNOLOGY TRENDS
Louis Cuccia *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 27-58 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

A chronology of space-Earth interconnectivity is presented. The Advanced Communications Technology Satellite (ACTS) system, Land Mobile Satellite, space-Earth antennas, impact of antenna size on coverage, intersatellite links are outlined. This presentation is represented by graphs and charts only. B.G.

N88-10089*# Air Force Space Div., Los Angeles, Calif.
SPACE ASSEMBLY, MAINTENANCE, AND SERVICING STUDY (SAMSS)
Joseph Wong *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 59-69 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The goal is to define and establish Space Assembly, Maintenance, and Servicing (SAMS) capabilities to meet requirements for improved space systems. Consolidated requirements, hardware/tool concepts, systems analysis, related studies interaction, and schedule/milestones are outlined. This presentation is represented by charts and figures only. B.G.

N88-10090*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TELEROBOTICS c37
Donna L. Pivirotto *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 71-75 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 13I

This presentation summarizes NASA's future plans and current technology programs for telerobotics and is represented by charts. Author

N88-10091*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACECRAFT SYSTEMS WORKING GROUP REPORT
John E. Keigler (RCA Astro-Electronics Div., Princeton, N. J.) and Larry F. Rowell *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 85-107 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

Issues addressed include: definition of user/commercial/government needs by function; criteria for prioritization of needs; overall criteria for technology assessment; system configuration drivers (key trade studies); space infrastructure interface; and cost drivers (pros and cons of standardization, manufacturing, test, serviceability, and supportability). B.G.

N88-10092*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYSTEM DEVELOPMENT WORKING GROUP REPORT
William L. Smith (TRW Space Technology Labs., Redondo Beach, Calif.) and William J. Bifano *In its* Spacecraft 2000 Jul. 1986 p 109-116 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The critical need is the need for funding and testing as bridging support for highly leveraged technology of Spacecraft 2000 to promote flight development introduction and acceptance. Critical needs are foreseen to augment these capabilities to satisfy specific enabling technology validation and to flight qualify selected technologies. Recommendations are summarized. This presentation is represented by figures. B.G.

N88-10093*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURES AND MATERIALS WORKING GROUP REPORT
Robert Torczyner (Lockheed Missiles and Space Co., Sunnyvale, Calif.) and Brantley R. Hanks *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 117-134 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The appropriateness of the selection of four issues (advanced materials development, analysis/design methods, tests of large flexible structures, and structural concepts) was evaluated. A cross-check of the issues and their relationship to the technology drivers is presented. Although all of the issues addressed numerous drivers, the advanced materials development issue impacts six out of the seven drivers and is considered to be the most crucial. The advanced materials technology development and the advanced design/analysis methods development were determined to be enabling technologies with the testing issues and development of structural concepts considered to be of great importance, although not enabling technologies. In addition, and of more general interest and criticality, the need for a Government/Industry commitment which does not now exist, was established. This commitment would call for the establishment of the required infrastructure to facilitate the development of the capabilities highlighted through the availability of resources and testbed facilities, including a national testbed in space to be in place in ten years. B.G.

N88-10094*# Grumman Aerospace Corp., Bethpage, N.Y.
THERMAL CONTROL WORKING GROUP REPORT
Robert Haslett and E. Thomas Mahefkey (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.) *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 135-147 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The Thermal Control Working Group limited its evaluation to issues associated with Earth orbiting and planetary spacecraft with power levels up to 50 kW. It was concluded that the space station technology is a necessary precursor but does not meet S/C 2000 needs (life, high heat flux, long term cryogenics, and survivability). Additional basic and applied research are required (fluid/materials compatibility and two phase system modeling). Scaling, the key issue, must define accelerated life test criteria. The two phase systems require 0g to 1 g correlation. Additional ground test beds are required and combined space environment tests of materials. B.G.

N88-10095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICAL POWER WORKING GROUP REPORT
Gerrit vanOmmering (Ford Aerospace and Communications Corp., Palo Alto, Calif.) and Ira T. Myers *In its* Spacecraft 2000 Jul. 1986 p 149-163 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The status of and need for power technologies for Spacecraft 2000 were assessed and development programs required to establish an achievable and competitive technology base for spacecraft of the 21st century were identified. The results are summarized, including the recommendations and the underlying rationale. B.G.

N88-10096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELEMETRY, TRACKING, AND CONTROL WORKING GROUP REPORT **c17**
Richard Campbell and L. Joseph Rogers *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 165-175 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 09F

After assessing the design implications and the criteria to be used in technology selection, the technical problems that face the telemetry, tracking, and control (TTC) area were defined. For each of the problems identified, recommendations were made for needed technology developments. These recommendations are listed and ranked according to priority. B.G.

N88-10097*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA MANAGEMENT WORKING GROUP REPORT **c82**
Edward J. Filardo (Rockwell International Corp., Seal Beach, Calif.) and David B. Smith *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 177-186 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 05B

The current flight qualification program lags technology insertion by 6 to 10 years. The objective is to develop an integrated software engineering and development environment assisted by an expert system technology. An operating system needs to be developed which is portable to the on-board computers of the year 2000. The use of ADA verses a High-Order Language; fault tolerance; fiber optics networks; communication protocols; and security are also examined and outlined. B.G.

N88-10098*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROPULSION WORKING GROUP REPORT **c20**
James Mavrogenis, James H. Kelley, and James R. Stone (National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.) *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 187-200 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 21H

Existing technology limits and performances, high payoff technologies, propulsion technologies, electric propulsion systems, and advanced bipropellant systems are outlined. B.G.

N88-10099*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE CONTROL WORKING GROUP REPORT
Daniel F. Reid (General Electric Co., Philadelphia, Pa.) and Phillip A. Studer *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 201-232 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The goals were to establish the Attitude Control System (ACS) requirements, constraints, technology assessment, technology shortfalls, expected in the year 2000. These were based upon all missions, military and civil, for LEO and GEO. The critical ACS technology issues were identified and ACS programs developed to address these critical issues. B.G.

N88-10100*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE STATION ASSEMBLY/SERVICING CAPABILITIES
Joseph Joyce *In its* Spacecraft 2000 Jul. 1986 p 77-84 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 22B

The aim is to place a permanently manned space station on-orbit around the Earth, which is international in scope. The program is nearing the close of the system definition and preliminary design phase. The first shuttle launch for space station assembly on-orbit

is estimated for January 1993. Topics perceived to be important to on-orbit assembly and servicing are discussed. This presentation is represented by charts. B.G.

N88-10101*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REDESIGN OF SOLID ROCKET BOOSTER/EXTERNAL TANK ATTACHMENT RING FOR THE SPACE TRANSPORTATION SYSTEM
Harvey G. McComb, Jr., comp. Oct. 1987 254 p
(NASA-TM-100476; NAS 1.15:100476) Avail: NTIS HC A12/MF A01 CSCL 22B

An improved design concept is presented for the Space Shuttle solid rocket booster (SRB)/external tank (ET) attachment ring structural component. This component picks up three struts which attach the aft end of each SRB to the ET. The concept is a partial ring with carefully tapered ends to distribute fastener loads safely into the SRB. Extensive design studies and analyses were performed to arrive at the concept. Experiments on structural elements were performed to determine material strength and stiffness characteristics. Materials and fabrication studies were conducted to determine acceptable tolerances for the design concept. An overview is provided of the work along with conclusions and major recommendations. Author

N88-10102# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
COS-B IN-ORBIT STUDY Final Report
Dieter Rossner Paris, France ESA Dec. 1986 82 p
(Contract ESTEC-5605/83-NL-PP(SC))
(ESA-CR(P)-2420; ETN-87-90882) Avail: NTIS HC A05/MF A01

Satellite in-orbit housekeeping data over the entire mission of the COS-B satellite was analyzed. The usefulness of the orbital data was limited by the precision available. Although the power subsystem provided the spacecraft and the payload with the required services over the mission lifetime, anomalies such as battery cell failure, battery capacity degradation, and 5 V supply line relay failure are detected. Temperature predictions show good agreement with flight temperatures concerning local gradients, sensitivities, and time variations. The absolute level, however, is too high by 4 to 6 C due to incorrect prototype test interpretation. Degradation of surface thermo-optical properties is less than expected. The attitude control system provided a higher thrust than specified (by 20%). The RF transmitter output power shows a long-term decrease. ESA

N88-10103*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
EFFICIENT PLACEMENT OF STRUCTURAL DYNAMICS SENSORS ON THE SPACE STATION
Janet A. Lepanto and G. Dudley Shepard 29 Sep. 1987 25 p
(Contract NAS9-17560)
(NASA-CR-172015; NAS 1.26:172015; CSDL-R-2012; UPN-906)
Avail: NTIS HC A03/MF A01 CSCL 22B

System identification of the space station dynamic model will require flight data from a finite number of judiciously placed sensors on it. The placement of structural dynamics sensors on the space station is a particularly challenging problem because the station will not be deployed in a single mission. Given that the build-up sequence and the final configuration for the space station are currently undetermined, a procedure for sensor placement was developed using the assembly flights 1 to 7 of the rephased dual keel space station as an example. The procedure presented approaches the problem of placing the sensors from an engineering, as opposed to a mathematical, point of view. In addition to locating a finite number of sensors, the procedure addresses the issues of unobserved structural modes, dominant structural modes, and the trade-offs involved in sensor placement for space station. This procedure for sensor placement will be applied to revised, and potentially more detailed, finite element models of the space station configuration and assembly sequence. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N88-10104*# Rockwell International Corp., Canoga Park, Calif. Propulsion Programs.
SPACE STATION PROPULSION TECHNOLOGY: SPACE STATION PROPULSION SYSTEM TEST BED TEST PLAN
G. L. Briley 22 Sep. 1986 55 p
(Contract NAS8-36418)
(NASA-CR-179201; NAS 1.26:179201) Avail: NTIS HC A04/MF A01 CSCL 21H

Testing of the hydrogen/oxygen Space Station Propulsion System will demonstrate the technology readiness for the IOC application. To facilitate early demonstration of this technology and to allow demonstration of maturing technology, this testing will be performed with the components installed on a test bed which simulated the Space Station Structure. The test plan contains a description of the test bed, test objective, instrumentation plan, and controls plan. Each of these is discussed in detail. B.G.

N88-10105# R and D Associates, Alexandria, Va. Research Lab.
MULTI-STAGE PLASMA THRUSTER Final Report, Nov. 1983 - Apr. 1985
Peter Turchi Jun. 1987 66 p
(Contract F04611-83-C-0033)
(AD-A183635; RDA-TR-127600-001; AFRPL-TR-85-069) Avail: NTIS HC A04/MF A01 CSCL 21C

Multi stage plasma propulsion offers the opportunity to extend electric population capabilities as space power levels develop. In this effort, the contractor considered an electric propulsion development strategy in which a family of thrusters was based on multiple stages of electromagnetic acceleration using the Teflon pulsed plasma thruster as the initial stage. Experimental tests explored three multi stage thruster configurations. The contractor concluded that multi stage can match mission power levels and transfer times. GRA

N88-10106*# Hughes Research Labs., Malibu, Calif.
AN 8-cm ION THRUSTER CHARACTERIZATION Supplementary Final Report, Mar. 1982 - Feb. 1983
F. J. Wessel, D. J. Hancock, C. R. Dulgeroff, and W. S. Williamson Oct. 1987 57 p
(Contract NAS3-22447)
(NASA-CR-180819; NAS 1.26:180819; HAC-E7324) Avail: NTIS HC A04/MF A01 CSCL 21H

The performance of the Ion Auxiliary Propulsion System (IAPS) thruster was increased to thrust T = 32 mN, specific impulse I sub sp = 4062 s, and thrust-to-power ratio T/P = 33 mN/kW. This performance was obtained by increasing the discharge power, accelerating voltage, propellant flow rate, and chamber magnetic field. Adding a plenum and main vaporizer for propellant distribution was the only major change required in the thruster. The modified thruster characterization is presented. A cathode magnet assembly did not improve performance. A simplified power processing unit

was designed and evaluated. This unit decreased the parts count of the IAPS power processing unit by a factor of ten. Author

N88-10107# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
THE NUMERICAL SIMULATION OF AN IDEALISED ONE-DIMENSIONAL, STEADY MONOPROPELLANT ROCKET
D. B. Spalding, K. Taylor, and J. Z. Y. Wu Dec. 1986 37 p
(PDR/IC-CFDU/31; ETN-87-90690) Avail: NTIS HC A03/MF A01

The PHOENICS computer code was applied to the two-phase-flow simulation of the one-dimensional, steady monopropellant rocket, for which an exact solution of the equations exists. Good agreement with this solution is demonstrated by the numerical simulation based upon the so-called shadow technique in the numerical model. It is shown that the problem can be readily specified by PHOENICS input language settings in a Q1 file and modified in subroutine GROUND. ESA

N88-10108# Royal Aircraft Establishment, Farnborough (England).
THE DESIGN AND DEVELOPMENT OF MERCURY VAPORISERS FOR USE WITH ELECTRON-BOMBARDMENT ION ENGINES
J. W. Pye Mar. 1970 51 p
(RAE-TR-70042; RAE-Space-332; BR19608; ETN-87-90939)
Copyright Avail: NTIS HC A04/MF A01

The principles of the design and construction of mercury vaporizers giving mass flow rates up to 1 mg/sec for ion engines are discussed. A simple tubular design using a heated porous plug within a cylindrical tube as a phase separator produced a vaporizer of small size, low mass, and high efficiency. The dominant parameter is the effective area and thickness of the porous plug. A plug of cylindrical geometry allows an appreciably higher mass flow rate for a given temperature than a simple disk of the same diameter. Theoretical mass flow rates were compared with experimental results using a theory based on the flow through a bundle of parallel capillaries. The very close agreement substantiates the validity of the approach. A satisfactory theory for the rate of cooling was also derived, although it assumes that heat loss is entirely by conduction. ESA

N88-10109# Royal Aircraft Establishment, Farnborough (England).
AN EXPERIMENTAL COMPARISON OF TWO DESIGNS OF MERCURY PROPELLANT TANK FOR USE WITH AN ELECTRIC PROPULSION ENGINE
R. B. Cork Nov. 1975 28 p
(RAE-TR-75109; RAE-Space-494; BR50050; ETN-87-90945)
Copyright Avail: NTIS HC A03/MF A01

Two designs of nitrogen blowdown propellant tank are described, an elastomeric bag and a metallic bellows. Measurements of their expulsion efficiencies are presented. In the absence of a suitable elastomer for the bag tank, it is recommended that the bellows tank be developed. ESA

N88-10098*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROPULSION WORKING GROUP REPORT
James Mavrogenis, James H. Kelley, and James R. Stone (National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.) *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 187-200 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

N88-10110*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANISMS OF POLYMER DEGRADATION USING AN OXYGEN PLASMA GENERATOR
Joe A. Colony and Edward L. Sanford Sep. 1987 11 p
(NASA-TM-100681; Rept-87B0476; NAS 1.15:100681) Avail: NTIS HC A03/MF A01 CSCL 07A

An RF oxygen plasma generator was used to produce polymer degradation which appears to be similar to that which has been observed in low Earth orbit. Mechanisms of this type of degradation were studied by collecting the reaction products in a cryogenic trap and identifying the molecular species using infrared, mass spectral, and X-ray diffraction techniques. No structurally dependent species were found from Kapton, Teflon, or Saran polymers. However, very reactive free radical entities are produced during the polymer degradation, as well as carbon dioxide and water. Reactions of the free radicals with the glass reaction vessel, with copper metal in the cold trap, and with a triphenyl phosphate scavenger in the cold trap, demonstrated the reactivity of the primary products. Author

N88-10111# National Bureau of Standards, Gaithersburg, Md.
NBS (NATIONAL BUREAU OF STANDARDS) RESEARCH REPORTS (APRIL 1987)
Apr. 1987 37 p
(PB87-210258; NBS/SP-721; LC-86-600603) Avail: NTIS HC A03/MF A01 CSCL 07A

Topics addressed include: research update; surface science; mapping microstructures; parallel processing; supercomputing; cancer prevention; micronutrient levels in the body; fundamental physical constants; hotel fire investigation techniques; atmospheric contaminants targets; new publications, and conference calendar. B.G.

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N88-10112# British Library Lending Div., Boston Spa (England).
OPTIMIZING THE APPLICATION OF HIGH TEMPERATURE CORROSION RESISTANT ALUMINIUM-SILICON-BASE COATINGS
B. S. Kukharev, I. A. Basalai, and L. S. Lyakhovich 1987 10 p
Transl. into ENGLISH from Izvest. VUZ, Chernaya Metall. (USSR), no. 11, 1986 p 106-110
(BLL-M-37222-(5828.4)) Avail: NTIS HC A02/MF A01

Mathematical models are used in experiments linking the composition of saturators in protective coatings applied to different types of steels with their high temperature corrosion resistance. Optimizing the saturator composition provides coatings which give the steels greatly increased high temperature corrosion resistance. Author

N88-10113# Boeing Military Airplane Development, Seattle, Wash.
COMPENDIUM OF POST-FAILURE ANALYSIS TECHNIQUES FOR COMPOSITE MATERIALS Interim Report, 18 Jul. 1984 - 18 Nov. 1986
Ray A. Grove and Brian W. Smith Jan. 1987 430 p
(Contract F33615-84-C-5010)
(AD-A183783; AFWAL-TR-86-4137) Avail: NTIS HC A19/MF A01 CSCL 11D

The objective of this document is to describe the analytical and diagnostic techniques that can be used to determine the causes of failure in continuous fiber reinforced composite materials. This

is a compendium of procedures which may be used as a reference manual when conducting a post-failure analysis. The major diagnostic procedures considered are fractography, materials characterization, non-destructive evaluation, and stress analysis. GRA

N88-10114# Cambridge Univ. (England). Dept. of Engineering.
JOINTS IN CARBON FIBRE REINFORCED COMPOSITES Final Report
P. A. Smith and K. J. Pascoe Jun. 1986 72 p
(Contract MOD-D/ERA/9/4/2029/0175)
(BR99969; ETN-87-90692) Copyright Avail: NTIS HC A04/MF A01

Static loading and fatigue of bolted joints were studied. Failure mechanisms in each ply for a variety of lay-ups and the way in which they combine to give failure are shown. Bearing strengths (in net-tension, shear-out, and bearing modes) are correlated with a stress analysis for quasi-isotropic laminates and finite element results for other lay-ups. Means of quantifying the effects of bolt clamp-up and laminate stacking sequence were developed. Fatigue testing of (0/90)ns bolted joints demonstrates the potential of the bearing stiffness as a damage parameter under cyclic loading and indicates the possibility of a stiffness based failure criterion. A data base for double-lap bonded joints confirms the usefulness of the strain energy release rate in quantifying bonded joint performance. ESA

N88-10115 National Physical Lab., Teddington (England). Div. of Materials Applications.
THE ANALYSIS OF MOISTURE ABSORPTION IN MULTI-LAYERED MEDIA
D. H. Ferriss Jun. 1987 17 p
(NPL-DMA(A)147; ISSN-0143-7313; ETN-87-90706) Copyright Avail: Issuing Activity

Equations representing unsteady one dimensional diffusion of moisture into multilayered media are presented. Analysis and numerical treatment enable the determination of the time variation of moisture mass absorbed into a composite medium. It is shown how this moisture mass depends on the thicknesses and diffusion properties of each layer. Results to illustrate behavior for short and long time scales are presented. ESA

N88-10116# Oak Ridge National Lab., Tenn. Fusion Engineering Design Center.
FACE COMPRESSION YIELD STRENGTH OF THE COPPER-INCONEL COMPOSITE SPECIMEN
T. Horie May 1987 24 p
(DE87-011974; ORNL/FEDC-87/4) Avail: NTIS HC A03/MF A01

A new equation for the face compression yield strength of copper-Inconel composite material has been derived. Elastic-plastic finite element analyses were also made for composite specimens with various aspect ratios to examine the edge effect of the specimen. According to the results of both the new equation and the analyses, the face compression yield strength of the composite should be decreased by about 25% from the value obtained with Becker's equation. DOE

N88-10117*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OUTGASSING DATA FOR SELECTING SPACECRAFT MATERIALS
William A. Campbell, Jr. and Richard S. Marriott Aug. 1987 323 p Revised
(NASA-RP-1124; Rept-87B0347; NAS 1.61:1124) Avail: NTIS HC A14/MF A01 CSCL 11D

Outgassing data, derived from tests at 398 K (125 C) for 24 hours in vacuum as per ASTM E 595-77, have been compiled for numerous materials for spacecraft use. The data presented are the total mass loss (TML) and the collected volatile condensable materials (CVCM). The various materials are listed by likely usage and alphabetically. Author

N88-10118# Office of Naval Research, London (England).
CERAMIC-CERAMIC COMPOSITES MEETING IN BELGIUM
Louis Cartz 4 Aug. 1987 7 p Conference was held in Mons, Belgium, 13-15 Apr. 1987
(ONRL-7-020-R) Avail: NTIS HC A02/MF A01

The problems of obtaining homogeneous dispersions of multicomponent systems were frequently discussed at this conference. The use of acoustic emission was shown to be a useful NDT analytical tool to detect the presence of microcracks in different places. The composite systems considered at the meeting included the following: zirconia-toughened aluminum (ZTA), SiC fiber-reinforced pyrex, SiC fiber-reinforced SiO2 glass matrix, mullite-zirconia-Al2O3-SiC, C-fiber-reinforced reaction-bonded SiC, ionic conducting NASICON-glass insulation composites, and alpha-AlON-Al2O3 composites. The zirconium oxycarbide system, ZrO2-ZrC sub x O sub y and ZrC-ZrC sub x O sub y composites are interesting, novel systems. Author

N88-10119# National Bureau of Standards, Gaithersburg, Md. Ceramics Div.
STRUCTURAL RELIABILITY AND DAMAGE TOLERANCE OF CERAMIC COMPOSITES FOR HIGH-TEMPERATURE APPLICATIONS
E. R. Fuller, T. W. Coyle, R. F. Krause, and T. J. Chuang Jun. 1987 31 p Sponsored by DOE, Oak Ridge, Tenn.
(PB87-208310; NBSIR-87/3564) Avail: NTIS HC A03/MF A01 CSCL 11D

The achievement of high efficiency heat engines and heat recovery systems requires the availability of high temperature, high performance structural materials. Structural ceramics, and more recently, ceramic matrix composites have received particular attention for these applications due to their high strength, and corrosion and thermal shock resistance. Even with these positive attributes, improved reliability and extended lifetime under service conditions are necessary for structural ceramics to gain industrial acceptance. The problem with these materials are mechanical and chemical in nature and are enhanced by the fact that they are subjected to high temperatures, reactive environments, and extreme thermal gradients. With an objective of improved performance for heat engines/heat recovery applications, the NBS program on structural ceramics and ceramic composites address these problems through the determinations of the critical factors which influence mechanical and microstructural behavior. The activities of the program are grouped under two subtasks, each designed to develop key data, associated test methods and companion predictive models. The status of the subtasks are detailed. GRA

N88-10120*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURE EFFECTS ON THE THERMAL STABILITY OF SiC FIBERS
Martha H. Jaskowiak and James A. DiCarlo 1986 16 p Presented at the 88th Annual Meeting of the American Ceramic Society, Chicago, Ill. 27 Apr. - 1 May 1986
(NASA-TM-100146; E-3704; NAS 1.15:100146) Avail: NTIS HC A03/MF A01 CSCL 11D

Commercially available polymer derived SiC fibers were treated at temperatures from 1000 to 2200 C in vacuum and argon gas pressure of 1 and 1360 atm. Effects of gas pressure on the thermal stability of the fibers were determined through property comparison between the pressure treated fibers and vacuum treated fibers. Investigation of the thermal stability included studies of the fiber microstructure, weight loss, grain growth, and tensile strength. The 1360 atm argon gas treatment was found to shift the onset of fiber weight loss from 1200 to above 1500 C. Grain growth and tensile strength degradation were correlated with weight loss and were thus also inhibited by high pressure treatments. Additional heat treatment in 1 atm argon of the fibers initially treated at 1360 atm argon caused further weight loss and tensile strength degradation, thus indicating that high pressure inert gas conditions would be effective only in delaying fiber strength degradation. However, if the high gas pressure could be maintained throughout

composite fabrication, then the composites could be processed at higher temperatures. Author

N88-10121*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTIES CHARACTERIZATION OF COMPOSITE SANDWICH MATERIALS INTENDED FOR SPACE ANTENNA APPLICATIONS
Kenneth J. Bowles and Raymond D. Vannucci 1986 17 p Presented at Test Methods and Design Allowables for Fiber Composites: 2nd Symposium, Phoenix, Ariz., 3-4 Nov. 1986; sponsored by the American Society for Testing and Materials (NASA-TM-88893; E-3310; NAS 1.15:88893) Avail: NTIS HC A03/MF A01 CSCL 11D

The composite materials proposed for use in the Advanced Communications Technology Satellite (ACTS) Program contains a new, high modulus graphite fiber as the reinforcement. A study was conducted to measure certain mechanical properties of the new fiber-reinforced material as well as of a composite-faced aluminum honeycomb sandwich structure. Properties were measured at -157, 22, and 121 C. Complete characterization of this material was not intended. Longitudinal tensile, picture-frame shear, short-beam shear, and flexural tests were performed on specimens of the composite face-sheet materials. Unidirectional, cross-plied, and quasi-isotropic fiber composite ply layup designs were fabricated and tested. These designs had been studied by using NASA's Integrated Composite Analyzer (ICAN) computer program. Flexural tests were conducted on (+/- 60/0 deg) sub s composite-faced sandwich structure material. Resistance strain gages were used to measure strains in the tensile, picture-frame, and sandwich flexural tests. The sandwich flexural strength was limited by the core strength at -157 and 22 C. The adhesive bond strength was the limiting factor at 121 C. Adhesive mechanical properties are reflected in sandwich structure flexural properties when the span-to-depth ratio is great enough to allow a significant shear effect on the load-deflection behavior of the sandwich beam. Most measured properties agreed satisfactorily with the properties predicted by ICAN. Author

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N88-10122 British Petroleum Co. Ltd., London (England).
SEPARATION OF ANIONIC FROM NONIONIC ALKOXY COMPOUNDS USING SILICA GEL Patent Application
Peter John Nicholas Brown, inventor, David John Harry Smith, inventor, and Edward John Tinley, inventor 28 Nov. 1984 4 p Filed 10 May 1984 Priority 12 May 1983 GB 8313079 (GB-Patent-2-140-415-A; GB-Patent-Appl-SN-8411940; Int-Patent-Class-C07C-139/14; ETN-86-98025) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1AY, United Kingdom

Anionic alkoxy compounds are separated from nonionic alkoxy compounds by a method which involves contacting a solution containing both materials with silica gel which preferentially adsorbs the anionic compounds. The latter may then be recovered by desorbing with a suitable solvent. The method is particularly suitable for purifying alkyl aryl ethoxy sulfonates formed by ethoxylation and sulfonation reactions which produce a crude product containing anionic and nonionic compounds. The purified compounds are suitable for use as surfactants in enhanced oil recovery. ESA

N88-10123 British Petroleum Co. Ltd., London (England).
RUTHENIUM CATALYSTS AND THEIR USE IN AMMONIA PRODUCTION Patent Application
John James McCarroll, inventor, Stephen Robert Tennison, inventor, and Nicholas Philip Wilkinson, inventor 26 Sep. 1984 8 p Filed 8 Mar. 1984 Priority 18 Mar. 1983 GB 8307612 (GB-Patent-2-136-704-A; GB-Patent-Appl-SN-8406125; Int-Patent-Class-B01J-23/58; ETN-86-98027) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1AY, United Kingdom

Catalysts are prepared by impregnating a carbon support with a halogen-containing compound of Ru, reducing the Ru to metal with hydrogen, and then depositing a promoting water stable alkali metal and a barium compound. The catalysts may be used for ammonia production. ESA

N88-10124 British Petroleum Co. Ltd., London (England).
PROCESS FOR THE PREPARATION OF ACYL HALIDES Patent Application
Alexander George Kent, inventor 1 Aug. 1984 3 p Filed 19 Jan. 1984 Priority 19 Jan. 1983 GB 8301463 (GB-Patent-2-133-792-A; GB-Patent-Appl-SN-8401412; Int-Patent-Class-C07C-53/40; Int-Patent-Class-C07C-51/10; ETN-86-98028) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1AY, United Kingdom

An acyl halide, e.g., acetyl chloride, is prepared by the reaction of an alkyl halide, e.g., methyl chloride, with carbon monoxide in the presence of a cobalt catalyst and, as promoter, an iodide or bromide which is a compound containing a quaternary Group 5 atom. The compound containing the quaternary Group 5 atom may either be used as such, or generated in situ by quaternization of a trivalent nitrogen or phosphorus containing compound. ESA

N88-10125# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Anlagentechnik.
PRMIXN: A COMPUTER PROGRAM FOR THERMOPHYSICAL PROPERTIES OF REAL GASES AND GAS MIXTURES [PRIMIXN: EIN RECHENPROGRAMM FUER THERMOPHYSIKALISCHE STOFFGROESSEN REALER GASE UND GASGEMISCHE]
H. Fulfs 1986 77 p In GERMAN; ENGLISH summary (GKSS-86/E/59; ISSN-0344-9629; ETN-87-90389) Copyright Avail: NTIS HC A05/MF A01

The code PRMIXn for the determination of properties of state and transport of real gases (all elementary gases as well as technically important gaseous compounds) and their mixtures in the pure gaseous state, is described. The code is a single precision function written in FORTRAN 77. The code calculates the properties as a function of pressure (between 1 and 200 bar) and temperature (between 200 and 200 K). The algorithms used, and modifications are documented. For a variety of pure gases and gas mixtures, each property was compared to corresponding values from the literature; the agreement is good or even very good. ESA

N88-10126 National Physical Lab., Teddington (England). Div. of Materials Applications.
VISCOSITY MEASUREMENTS AT HIGH TEMPERATURES ON A STANDARD REFERENCE MATERIAL SUPPLIED BY BCR
S. Bagha and K. C. Mills Apr. 1987 31 p (NPL-DMA(A)146; ISSN-0143-7313; ETN-87-90705) Copyright Avail: Issuing Activity

High temperature viscosity measurements were obtained on a lithium aluminosilicate standard reference material (SRM) using the rotating bob technique. The SRM is found to be chemically and thermally stable, and gives a consistent and reproducible set of values. Similar values of the viscosity are obtained using molybdenum and graphite. ESA

N88-10127# Pacific Northwest Labs., Richland, Wash.
OXIDATION OF TSX GRAPHITE OVER THE TEMPERATURE RANGE 450 TO 1200C
L. R. Bunnell, T. K. Campbell, and G. L. Tingey Mar. 1987 8 p Presented at the 63rd Biennial Carbon Conference, Worcester, Mass., 9 Jul. 1987 (Contracts DE-AC06-76RL-01857; DE-AC06-76RL-01830) (DE87-012230; UNI-SA-207; PNL-SA-14925; CONF-870796-1) Avail: NTIS HC A02/MF A01

In the past, studies have been performed on the oxidation of many grades of graphite over a wide temperature range. The

accident at Chernobyl and subsequent analysis of the N Reactor prompted interest in obtaining data on the oxidation rate of TSX graphite, the type from which N Reactor was built. Work has concentrated on oxidation of TSX graphite by air at temperatures from 450 to 1200 C. Oxidation is determined by density measurements. Experimental results are presented. DOE

N88-10128# National Bureau of Standards, Gaithersburg, Md. Office of Standard Reference Data.
STANDARD REFERENCE DATA PUBLICATIONS, 1985-1986
J. C. Sauerwein Jun. 1987 43 p
(PB87-210241; NBS/SP-708-Suppl-1) Avail: NTIS HC A03/MF A01; also available SOC HC $2.00 as 003-003-02802-9 CSCL 07D

The National Bureau of Standards, Office of Standard Reference Data manages a network of data centers that prepare evaluated databases of physical and chemical properties of substances. Databases are available in printed form, on magnetic tapes, diskettes, and through on-line computer networks. The document provides a comprehensive list of the products available from the National Standard Reference Data System (NSRDS) for the years 1985 to 1986, including indexes qualified by author, material, and property terms. Ordering information and current prices can be found at the end of the document. GRA

N88-10129# SRI International Corp., Menlo Park, Calif.
LASER PROBES OF NATURAL GAS IGNITION CHEMISTRY Final Report, Jan. 1984 - Dec. 1986
D. R. Crosley Jan. 1987 138 p
(Contract GRI-5038-260-0896)
(PB87-209599; SRI-MP-87-049; GRI-87/0114) Avail: NTIS HC A07/MF A01 CSCL 21B

The research described is aimed at developing laser-induced fluorescence of various hydrocarbon species for use as probes in natural gas combustion research, and developing an understanding of the mechanisms of ignition and the formation of chemiluminescent emission in such flames. Measurements were made of two-dimensional imaging and the relationship between ignition chemistry and chemiluminescence for the OH and CH radicals, in flames at atmospheric and reduced pressure, and in a laser pyrolysis system. Measurements were performed on collisional quenching, energy transfer, and transition probabilities for the OH, CH, and CH3O radicals, in flames and discharge flow systems. Transition state theory calculations were performed and parameters codified for bimolecule reactions important in natural gas combustion, with special emphasis of the disputed methyl-methyl recombination rate constant. GRA

N88-10130# Lawrence Livermore National Lab., Calif.
NITROGEN AT HIGH PRESSURE
W. J. Nellis Jul. 1987 8 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-48)
(DE87-013797; UCRL-96768; CONF-870753-68) Avail: NTIS HC A02/MF A01

High-pressure results for nitrogen are reviewed and discussed in terms of phenomena that occur at extreme conditions. Included are: equation of state in shock compression, dissociation, pressure effects on Raman spectra and mp, etc. DOE

N88-10131# Lawrence Livermore National Lab., Calif.
NITROGEN AT VERY HIGH PRESSURE
W. J. Nellis Jul. 1987 11 p Presented at the 11th International AIRAPT Conference, Kiev, USSR, 12 Jul. 1987
(Contract W-7405-eng-48)
(DE87-013800; UCRL-97186; CONF-870754-3) Avail: NTIS HC A03/MF A01

High-pressure results for nitrogen are reviewed and discussed in terms of phenomena that occur at extreme conditions. DOE

N88-10132*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF NASA ADVANCED DESIGNS ON THERMAL BEHAVIOR OF Ni-H2 CELLS
Olga D. Gonzalez-Sanabria 1987 16 p Presented at the Annual Meeting of the American Institute of Chemical Engineers, New York, N.Y., 15-20 Nov. 1987
(NASA-TM-100197; E-3790; NAS 1.15:100197) Avail: NTIS HC A03/MF A01 CSCL 10C

As part of an overall effort to advance the technology of nickel-hydrogen batteries for low Earth orbit (LEO) applications, advanced designs for individual pressure vessel (IPV) nickel-hydrogen cells have been conceived. These designs incorporate alternative methods of oxygen recombination which affect the thermal behavior of the cells. The effect of these oxygen recombination methods on the cell temperature profiles is examined. Author

N88-10133# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physical Chemistry and Electrochemistry.
STUDIES OF TRANSPORT PROCESSES IN POROUS AND ION EXCHANGE MEMBRANES Ph.D. Thesis
Pirkko Forssell 1987 36 p
(ISBN-951-99847-0-4; ETN-87-90731) Avail: NTIS HC A03/MF A01

The Nernst-Planck equations are applied to describe systems where diffusion, migration, and solvent flow contribute to the mass transport of strong electrolytes across porous membranes. Countercurrent electrolysis in a porous membrane used to separate ions from mixtures is studied. The ability of the Nernst-Planck model to predict the behavior of strong electrolytes in porous membranes at low concentrations is shown. The transport of cations in a cation exchange membrane is examined to develop a continuous model for the transport processes in an ion exchange membrane. The membrane used is a polystyrene-sulfonate cation exchange membrane and the total concentration of the solution is so low that the concentration of coions is negligible. A method for measuring the transport numbers of counterions as a function of the concentration of the counterions in the membrane in multi-ionic systems is assessed. The determination of the tracer diffusion coefficients of counterions is considered. ESA

N88-10134# Karlsruhe Univ. (West Germany). Fakultaet fuer Chemieingenieurwesen.
TURBULENT BUNSEN BURNER FLAMES Ph.D. Thesis [TURBULENTE BUNSENFLAMMEN STRUKTUR UND FLAMMENGESCHWINDIGKEIT]
Henning Hoffmann 1986 145 p In GERMAN
(ETN-87-90433) Avail: NTIS HC A07/MF A01

Parameter studies with several measuring techniques were performed for the description of the reaction stucture and flame speed of turbulent Bunsen flames. A four-beam laser Doppler anemometer, an ionization gage, a platinum-rhodium thermoelement, a microphone probe, and concentration measuring apparatus were used. The results show that the turbulent flame front structure is not hindered by external effects, and that the folding of the flame front is determined by the macroturbulence and an eigeninstability. The reaction zone structure and length of the flame are essentially determined by the turbulence state of the fresh gas flow. Increasing turbulence leads to higher flame speeds. With increasing distance to the burner outlet, the reaction zone spreads more and more into the inner fresh gas stream. Compared to other flame systems, Bunsen flames have the lowest average flame speeds. ESA

N88-10135# Lawrence Livermore National Lab., Calif.
CHEMICAL EQUILIBRIUM CALCULATIONS FOR THE HIGH PRESSURE AND TEMPERATURE DISSOCIATION OF LIQUID NITROGEN
D. C. Hamilton and F. H. Ree Jul. 1987 5 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-48)

(DE87-013788; UCRL-96521; CONF-870753-64) Avail: NTIS HC A02/MF A01

Calculations are reported for the equation-of-state properties of shock-compressed liquid nitrogen. The statistical mechanical, chemical equilibrium calculations, which allow for the simultaneous presence of both the diatomic and monatomic forms of nitrogen, show good agreement with recent dynamic experiments. DOE

N88-10136# Lawrence Livermore National Lab., Calif.
THE DISSOCIATION OF DENSE LIQUID NITROGEN AND SHOCK COOLING
M. Ross Jul. 1987 6 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-48)
(DE87-013490; UCRL-96528; CONF-870753-53) Avail: NTIS HC A02

A theoretical model is used to examine the dissociation of shock-compressed liquid nitrogen. An important feature of the model is the introduction of a binding energy for the atomic state which leads to a volume-dependent dissociation energy. The model correctly predicts the highly unusual feature of shock cooling which is shown to be the consequence of the volume dependent dissociation energy. DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N88-10137# Colorado School of Mines, Golden. Dept. of Metallurgical Engineering.
A PHYSICAL METALLURGICAL BASIS FOR HEAT-AFFECTED ZONE AND BASE-PLATE PROPERTIES OF A MICROALLOYED HSLA STEEL Final Report, 1984 - 1986
Roger A. Nichting and Elliot L. Brown Dec. 1986 384 p
(Contract N00167-83-R-00159; RS3-4550)
(AD-A180200; T-3136; DTNSRDC/SME-CR-24-86) Avail: NTIS HC A17/MF A01 CSCL 11F

The processing structure property relationship associated with the heat-affected zone (HAZ) produced in an HSLA microalloyed steel during arc welding is discussed. Single pass submerged arc welds on a Nb-V microalloyed steel were made with variable heat input. The thermal cycle as a function of heat input and position in the HAZ was determined experimentally in the course of welding. In addition, weld simulations were produced for selected heat inputs and HAZ locations. The evolution of austenite and transformation product microstructure as well as the state of microalloy precipitation was monitored as a function of heat input and HAZ location primarily via light and electron microscopy on actual welds and simulation specimens. These observations support efforts to model austenite microstructure evolution and continuous cooling transformation behavior in the HAZ. Charpy impact toughness testing was performed on actual weld HAZ and selected simulation specimens. Impact transition curves were determined and the microstructure through which fracture propagated was correlated with impact transition energies and fracture surface morphology determined via electron microscopy. GRA

N88-10138# Royal Aircraft Establishment, Farnborough (England).
ISOTHERMAL FORGING AND ITS EFFECT ON THE MICROSTRUCTURE OF POWDER ROUTE NICKEL ALLOY AP1
C. Wilkinson Sep. 1986 39 p
(RAE-TM-P-1094; BR101484; ETN-87-90268) Copyright Avail: NTIS HC A03/MF A01

The influence of initial billet hot isostatic pressing treatment and forging parameters on the microstructure of isothermally formed powder AP1 were investigated. Strain, strain rate, and forging temperature were varied using a microprocessor controlled servo hydraulic press. The metallographic structures produced were examined using optical and electron beam techniques. The ratio of warm worked to recrystallized grains within each forged billet was determined. Data are presented as structure maps which relate the degree of recrystallization to the forging variables. Stress/strain data, measured during forging operations, are presented. ESA

N88-10139# Brookhaven National Lab., Upton, N. Y.
DE-ALLOYING
K. Sieradzki, R. C. Newman, and T. Shahrabi 1987 19 p Presented at the International Conference on Localized Corrosion, Orlando, Fla., 1 Jun. 1987 Prepared in cooperation with Manchester Univ., England
(Contract DE-AC02-76CH-00016)
(DE87-012488; BNL-40004; CONF-870658-3) Avail: NTIS HC A03/MF A01

Recent advances in the atomistic theory of de-alloying are outlined, together with electrochemical considerations such as near-equilibration of the noble alloy component with occluded environments. The best description of dealloying is a percolation process modified by surface diffusion, site-dependent dissolution, and possibly exchange-current surface restructuring. DOE

N88-10140# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF RAPIDLY-SOLIDIFIED DISPERSION STRENGTHENED TITANIUM ALLOYS Annual Report, Sep. 1985 - Aug. 1986
David B. Snow 1 Jul. 1987 103 p
(Contract N00014-83-C-0426)
(AD-A183882; UTRC/R87-917553-2) Avail: NTIS HC A06/MF A01 CSCL 11F

Significant potential exists for the improvement of high temperature strength in titanium base alloys by the addition of rare earth elements, followed by rapid solidification and aging. To investigate this potential, the relative effectiveness with which several different rare earth elements form oxide dispersions in splat-quenched Ti-Al solid solutions was examined, using Ti-A-Er as a basis of comparison. The alloying elements of this type which were utilized included yttrium, lanthanum, neodymium, gadolinium, terbium, dysprosium, erbium and lutetium, added individually in amounts of approx. 0.5 at % each. Procedures were developed to prepare rapidly solidified laboratory quantities of these alloys by arc melting and splat quenching in the same apparatus, followed by aging in high purity argon. The dispersions formed in these alloys both before and after aging at 800 C were examined and compared by analytical transmission electron microscopy. While it was not generally possible to completely suppress the precipitation of intercellular oxides by splat quenching to thicknesses of greater than 60 microns, in all cases most of the yttrium or the rare earth components of the alloy was retained in supersaturated solid solution. GRA

N88-10141# Bundesanstalt fuer Materialpruefung, Berlin (West Germany). Lab. Mechanische und Thermische Pruefverfahren.
THE APPLICATION OF GROUP RADIATORS FOR THE DETERMINATION OF TENSION CRACK CORROSION [ANWENDUNG VON GRUPPENSTRAHLERN FUER DEN NACHWEIS VON SPANNUNGSRISSKORROSION]
H. Wuestenberg, W. Wegner, W. Moehrle, and G. Schenk 23 Dec. 1985 93 p In GERMAN
(BAM-06264; ETN-87-90395) Avail: NTIS HC A05/MF A01

Ultrasonic group radiators were realized for the variation of the angular spectrum of ultrasonic probes, for the adaptation of ultrasound fields to horizontal and azimuthal sloping positions of cracks. The ultrasonic fields were focussed by the simultaneous balancing of a lens curvature, thereby improving the signal-to-noise ratio for crack fields or coarse-grained materials. Sidelobe suppression was optimized. The evaluation and prediction safety of the measurement results were improved by automation of the data acquisition and data storage for amplitude and time of flight using a small computer, which also controls the scanning of the radiation bundle. The system proves to be successful in practice. ESA

N88-10142 Fraunhofer-Inst. fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE EFFECT OF FRETTING CORROSION ON THE FATIGUE STRENGTH OF STEEL AND CAST IRON UNDER SINUSOIDAL AND RANDOM LOADING
G. Fischer 1987 58 p In GERMAN; ENGLISH summary Sponsored by Vereins Deutscher Giessereifachleute and Arbeitsgemeinschaft Industrieller Forschungsvereinigungen
(LBF-FB-177; ISSN-0721-5320; ETN-87-90400) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany DM 95

The surface pressures and relative deformations due to fretting corrosion damage were determined on two steel components. A test facility for the production of fretting corrosion was designed and constructed. The difference between the effect of fretting corrosion under sinusoidal and random loading was determined. The accuracy of fatigue life estimates using the test results and damage calculations is discussed. The measures to be taken for the avoidance of fretting corrosion are proposed. ESA

N88-10143# European Space Agency, Paris (France).
CONTRIBUTION TO THE STUDY OF THE TI-AI PHASE DIAGRAM BY CONVENTIONAL AND HIGH RESOLUTION ELECTRON MICROSCOPY
A. Loiseau Mar. 1987 380 p Transl. into ENGLISH of Contribution a l'Etude du Diagramme de Phase Ti-Al par Microscopie Electronique Conventionelle et Haute Resolution (Chatillon, France, ONERA) 1985 Original language document announced as N87-13538
(ESA-TT-1021; ONERA-NT-1985-6; ETN-87-90663) Avail: NTIS HC A17/MF A01

The study of long range order effects by electron diffraction and electron microscopy was carried out to help to establish the topology of the Ti-Al phase diagram. The stability and equilibrium of different compounds is discussed, including AlTi, Ti2Al, and Ti3Al5. Long period antiphase boundary structures are also examined for alloys containing 66% to 75% Al. It is shown that boundary structure distribution along the long-period axis is always uniform and that temperature dependence may correspond to a so-called devil staircase. ESA

N88-10144# Royal Aircraft Establishment, Farnborough (England).
SUPERPLASTIC DEFORMATION AND POST FORMING TENSILE PROPERTIES OF TI-6AI-4V SHEET
C. D. Ingelbrecht Feb. 1986 34 p
(RAE-TR-86015; RAE-Mat/Struct-157; BR100004; ETN-87-90698) Copyright Avail: NTIS HC A03/MF A01

Flow stress and strain rate sensitivity were measured for 6 batches of Ti-6Al-4V sheet of thickness 0.9 to 3.3 mm superplastically deformed in tension at 925 C at strain rates in the range 0.00002 to 0.004/sec. Room temperature tensile tests were carried out on material mill annealed (as-received), annealed at 925 C, and superplastically deformed at 925 C. Annealing at the forming temperature (925 C) reduces the 0.2% proof stress by 8% to 12%, and the tensile strength by 1% to 10% compared with mill annealed material. Superplastic true strain of 0.9 reduces the 0.2% proof stress and the tensile strength by a further 2%. Superplastic deformation reduces texture intensity in the alpha and beta phases, although the starting texture does not influence the superplastic deformation. ESA

N88-10145# Arizona Univ., Tucson. Dept. of Physics.
METALLIC SUPERLATTICES WITH MONOLAYER MODULATION
J. L. Makous, C. M. Falco, R. Vaglio, and A. Cucolo 1987 3 p Presented at the 18th Conference on Low Temperature Physics, Kyoto, Japan, 20 Aug. 1987 Prepared in cooperation with Salerno Univ., Italy
(Contract DE-FG02-87ER-45297)
(DE87-012724; DOE/ER-45297/1; CONF-870873-10) Avail: NTIS HC A02

We report the preparation and characterization of sputtered Mo/Ta superlattices where the wavelengths are modulated by integer numbers of atomic monolayers. Resistivity and tunnel junction measurements on Mo/Ta superlattices with wavelengths in the range from 153 atomic planes each of Mo and Ta to the monolayer limit of 1 atomic plane of each are found to be consistent with their structural properties as determined by X-ray analyses. In addition, these results are consistent with earlier studies on the phonon structure of Mo/Ta using Brillouin scattering. DOE

N88-10146# Arizona Univ., Tucson.
SUPERCONDUCTING PROPERTIES OF METALLIC SUPERLATTICES
C. M. Falco, J. L. Makous, A. Cucolo, L. Maritato, and R. Vaglio 1987 12 p Presented at the 8th Winter Meeting on Low Temperature Physics, Cuernavaca, Mexico, 18 Jan. 1987 Prepared in cooperation with Salerno Univ., Italy
(Contract DE-FG02-87ER-45297)
(DE87-012725; DOE/ER-45297/2; CONF-870182-1) Avail: NTIS HC A03/MF A01

The preparation by sputtering of artificial metallic superlattices is described, as are the results of X-ray structural determinations. Tunneling and resistivity measurements on these materials are reported. DOE

N88-10147# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF CREEP RESISTANT AUSTENITIC STAINLESS STEELS FOR ADVANCED STEAM CYCLE SUPERHEATER APPLICATION
P. J. Maziasz and R. W. Swindeman 1987 29 p Presented at the Fossil Energy Materials Program Conference, Oak Ridge, Tenn., 19 May 1987
(Contract DE-AC05-84OR-21400)
(DE87-012929; CONF-8705103-9) Avail: NTIS HC A03/MF A01

The compositions of several 14Cr-16Ni austenitic stainless steels were modified with combinations of minor and residual alloying elements to produce excellent creep strength based on unique precipitate microstructures. These modifications produce fine MC and phosphide precipitates in the matrix for strength and various coarser carbide phases along the grain boundaries for ductility and rupture resistance. Creep-rupture resistance of these modified 14-16 steels is much better than that of type 316 or Inconel 800H and better than that of 17-14CuMo at 700 C in the mill-annealed condition. Analysis of microstructure and correlation with creep properties suggests that precipitate effects are primarily responsible for the properties improvement. The ideas and insight for design of the novel precipitate microstructures stem from microcompositional information obtained using state-of-the-art analytical electron microscopy (AEM). DOE

N88-10148 Princeton Univ., N. J.
SURFACE MODIFICATION BY METAL DEPOSITION AND LASER IRRADIATION Ph.D. Thesis
Chih-Chen Cho 1987 145 p
Avail: Univ. Microfilms Order No. DA8712518

Modification of solid surfaces was investigated from two perspectives: deposition of metal from organometallic adsorbates and surface response to high power pulsed laser irradiation. In the study of Mo metal deposition from decomposition of Mo(CO)6, X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), thermal desorption spectroscopy (TDS), and low energy electron diffraction (LEED) were employed. Responses of Ni(100) and Mo(100) single crystals to Q-switched, frequency doubled Nd:YAG laser pulses were characterized by LEED, particularly via spot profile and spot-spot distance analysis. Mo(CO)6 was found to physisorb on Si, Mo, and Cu surfaces at low temperature and desorb with zero-order kinetics. Different mechanisms for photolytic, pyrolytic, and electron-induced Mo(CO)6 decomposition were suggested. In the study of the effect of pulsed laser irradiation on metal surfaces, epitaxial regrowth of the laser-melted surfaces was indicated by appearance of well defined LEED patterns. However, random islands and mosaic structures

were produced on the laser irradiated surfaces. Analysis of LEED spot profiles as a function of incident electron energy and annealing time at 1000 to 1100 C indicated these defects coalesced with prolonged heating. Successful application of LEED spot profile and spot-spot distance analysis in characterization of laser irradiated surfaces suggests high potential of this technique as a new probe in studies of laser-solid interactions. Mo(CO)6 decomposition were suggested. Dissert. Abstr.

N88-10149# National Bureau of Standards, Gaithersburg, Md. Metallurgy Div.
EVALUATION OF CRACKING IN ALUMINUM CYLINDERS Final Report
J. H. Smith Mar. 1987 52 p Sponsored by DOT, Washington, D.C.
(PB87-201398; NBSIR-86/3492) Avail: NTIS HC A04/MF A01 CSCL 11F

Cracking was first observed in the threaded area of high pressure fiberglass-wrapped composite-aluminum compressed gas cylinders and has resulted in the leaking and rupture of a few of these cylinders in the last three years. More recently, the neck and threaded area of some fiberglass-wrapped composite-aluminum and some seamless aluminum cylinders were visually inspected during the normal periodic retest. As a result of this visual inspection at the time of retesting, several aluminum cylinders were reported to show evidence of cracking in the neck and threaded area. A group of these cylinders was obtained for more detailed laboratory examination to determine the extent of the cracking and to attempt to assess the significance of the cracking. The results of the laboratory test on this group of cylinders that were reported to have cracks are described. GRA

N88-10150# California Univ., Berkeley. Lawrence Berkeley Lab.
FATIGUE AND THERMAL FATIGUE OF Pb-Sn SOLDER JOINTS
D. Frear, D. Grivas, M. McCormack, D. Tribula, and J. W. Morris, Jr. Jan. 1987 12 p Presented at the American Institute of Metallurgical Engineers Annual Meeting: Light Metals Session, Denver, Colo., 22 Feb. 1987
(Contract DE-AC03-76SF-00098)
(DE87-012881; LBL-22837; CONF-870272-6) Avail: NTIS HC A03/MF A01

This paper presents a fundamental investigation of the fatigue and thermal fatigue characteristics, with an emphasis on the microstructural development during fatigue, of Sn-Pb solder joints. Fatigue tests were performed in simple shear on both 60Sn-40Pb and 5Sn-95Pb solder joints. Isothermal fatigue tests show increasing fatigue life of 60Sn-40Pb solder joints with decreasing strain and temperature. In contrast, such behavior was not observed in the isothermal fatigue of 5Sn-95Pb solder joints. Thermal fatigue results on 60Sn-40Pb solder cycled between -55°C and 125°C show that a coarsened region develops in the center of the joint. Both Pb-rich and Sn-rich phases coarsen, and cracks form within these coarsened regions. The failure mode 60Sn-40Pb solder joints in thermal and isothermal fatigue is similar: cracks form intergranularly through the Sn-rich phase or along Sn/Pb interphase boundaries. Extensive cracking is found throughout the 5Sn-95Pb joint for both thermal and isothermal fatigue. In thermal fatigue the 5Sn-95Pb solder joints failed after fewer cycles than 60Sn-40Pb. DOE

N88-10151# Los Alamos National Lab., N. Mex.
LOW TEMPERATURE DEPOSITION BY LASER INDUCED BREAKDOWN IN THE VAPOR PHASE
T. R. Jervis and E. L. Joyce, Jr. 1987 12 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract W-7405-eng-36)
(DE87-007509; LA-UR-87-1035; CONF-871027-3) Avail: NTIS HC A03/MF A01

We have developed a new technique for deposition on low temperature substrates driven by laser induced dielectric breakdown of gas phase precursors. Metal films of Ni, Fe, and refractory metal alloys show excellent grain refinement and metastable phase incorporation due to rapid quenching from the gas phase. The technique, including the role of gas phase nucleation and growth in the formation of the films, is described. DOE

N88-10152# Allied Bendix Aerospace, Kansas City, Mo.
EQUATIONS FOR DETERMINING CVD TUNGSTEN-RHENIUM ALLOY COMPOSITION AND PLATING RATE
P. E. Klingsporn Apr. 1987 14 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC04-76DP-00613)
(DE87-008831; BDX-613-3695; CONF-871027-19) Avail: NTIS HC A03/MF A01

The composition and plating rate of CVD tungsten-rhenium alloy, formed by hydrogen reduction of a tungsten and rhenium metal hexafluoride gas mixture on a heated substrate, depend on the substrate temperature, hydrogen gas flow, metal fluoride gas flow, and the pressure. An equation was derived that allows the alloy composition to be calculated for any combination of the variables, based on the measured composition for one set of the variables. Also, equations were derived from which the W-Re alloy plating rate can be calculated in terms of the measured rate and composition at one set of the variables, or, in terms of the measured rates at two sets of the variables, without knowledge of the composition. W-Re alloy compositions and plating rates calculated with the equations were compared with experimental data. DOE

N88-10153# Lawrence Livermore National Lab., Calif.
LARGE-STRAIN SOFTENING OF ALUMINUM AT ELEVATED TEMPERATURE
M. E. Kassner and J. J. Oldani 11 Jun. 1987 7 p Presented at the International Conference on Materials Technology, Santiago, Chile, 4 Oct. 1987
(Contract W-7405-eng-48)
(DE87-011559; UCRL-96344; CONF-871099-2) Avail: NTIS HC A02

Recent work has shown that Al that is torsionally deformed to large strains at elevated temperature hardens to a peak stress beyond which a strain-softening is observed. This softening has been attributed to changes in the microstructure, a new operating deformation mechanism due to the dramatic increase in high-angle grain boundary area with increasing strain, or the evolution of a texture. New experiments and analysis are presented that support the conclusion that the large-strain softening is the result of a texture. DOE

N88-10154# Lawrence Livermore National Lab., Calif.
DEVELOPMENT OF ULTRAFINE GRAINS AND RELATED PROPERTIES IN HADFIELD MANGANESE STEELS
A. Goldberg and O. D. Sherby 16 Jun. 1987 10 p Presented at the International Conference on Materials Technology, Santiago, Chile, 4 Oct. 1987 Prepared in cooperation with Stanford Univ., Calif.
(Contract W-7405-eng-48)
(DE87-011884; UCRL-95988; CONF-871099-1) Avail: NTIS HC A02/MF A01

Through appropriate thermomechanical processing, ultrafine grains were developed in Hadfield manganese steels. The austenite grains, 2- to 8-micron size, were stabilized against grain growth by dispersions of fine carbides, typically less than 1 micron. The steels contained from 1.2 to 1.7 wt % carbon and 12.3 to 16.3 wt % manganese. The processed materials were evaluated for superplastic properties at elevated temperatures (750 to 900 C). Values for the strain-rate sensitivity exponent (m) in the expression sigma = k epsilon dot(sup m) ranged from 0.37 to 0.65. The value of m was found to depend on composition, grain size, temperature, and strain rate. At 23 C the fine-grain steels showed higher yield strengths and hardness values, but lower ductility, relative to values reported for commercially processed materials. DOE

N88-10155# Sandia National Labs., Albuquerque, N. Mex.
HIGH VELOCITY EROSION OF METAL INTERFACES
R. J. Bourcier and L. C. Chhabildas 1987 5 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-013937; SAND-87-0768C; CONF-870753-66) Avail: NTIS HC A02/MF A01

A unique impact recovery experiment in which a truncated right conic section of 4340 steel is shot through a matching hole in a multi-material target has been used to study the high-velocity erosion of metal surfaces. A variety of metal alloys were examined, covering a wide range of both physical and mechanical properties. Projectile/target pairs of 15 and 30° cone angle have been impacted at 1.12 km/sec. The differences observed in the level of plastic deformation present in the target sections are attributable to target strength, impedance, and melt temperature. These experiments have been analyzed using metallographic examination and numerical simulation to characterize the extent and mode of near-surface deformation. The experiments lend insight into the nature of metal surface impacts and the physical/mechanical parameters which control metal erosion. DOE

N88-10156# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
OBSERVATIONS OF LOCALIZED GRAIN BOUNDARY DISLOCATIONS IN SERIES OF (001) AND (110) SYMMETRICAL TILT BOUNDARIES IN ALUMINUM
E. P. Kvam and R. W. Balluffi 20 Aug. 1987 4 p Prepared in cooperation with Liverpool Univ., England
(Contract DE-FG02-87ER-45310)
(DE87-014011; DOE/ER-45310/4) Avail: NTIS HC A02/MF A01

The present results demonstrate the existence of localized GBDs in series of (100) and (110) symmetric tilt boundaries in Al. These results suggest that extensive hierarchies of localized GBD structures exist in these series of boundaries similar to those found recently in (001) symmetric tilt boundaries in Au. Presumably these additional structures could be revealed by further careful microscopy carried out on a wider sampling of boundaries. The results are consistent with the structural unit/GBD description of these boundaries. They are also consistent with calculations for these symmetric boundaries which predict localized perfect GBDs having the shortest possible Burgers vectors normal to the boundary (and which also do not produce steps in the boundary). DOE

N88-10157# Helsinki Univ. of Technology, Espoo (Finland).
A QUANTITATIVE STATISTICAL MODEL FOR CLEAVAGE FRACTURE INITIATION IN CARBIDE STRENGTHENED STEELS Ph.D. Thesis
Kim R. W. Wallin May 1987 13 p Sponsored by the Foundation of Technology, Finland and the Imatran Voima Foundation
(ETN-87-90735) Avail: NTIS HC A03/MF A01

A micromechanism based statistical cleavage fracture initiation model for carbide strengthened steels is presented. The model assumes that cleavage fracture initiates when a critical combination of tensile stress and carbide size is achieved in the plastic enclave ahead of the crack tip. Because the stress distribution in front of a crack varies strongly on a relevant microstructural distance, the probability of finding a carbide of critical size within the highly stressed region governs the macroscopic fracture toughness. The critical carbide size is dictated by the magnitude of the maximum principal tensile stress and thus by the yield properties of the matrix. The higher the yield stress and the strain hardening capacity, the stronger is the stress intensification at the crack tip, and thus the lower is the critical carbide size. The model correlates the macroscopic brittle fracture toughness parameter with microstructural variables and tensile properties of the material. ESA

N88-10158# Technical Research Centre of Finland, Espoo. Metals Lab.
ON THE RELATIONS BETWEEN CYCLIC CONTRACTION RATIO, FLOW STRESS, AND DEFORMATION MECHANISMS IN BAINITIC CrMoV STEELS Ph.D. Thesis
Klaus Rahka Apr. 1987 107 p Sponsored by the Finnish Ministry of Trade and Industry
(VTT-36; ISBN-951-38-2855-7; ISSN-0358-5069; ETN-87-90738) Avail: NTIS HC A06/MF A01; Technical Research Center of Finland, Espoo, Finland FIM 95

The cyclic diametral strain and stress response of macroscopically untextured (nominally isotropic) bainitic Cr-Mo-V steels was studied. The total axial strain amplitudes were chosen so that a range of ratios of plastic and elastic elongations were used extending from 0.04 to 5. The trend of the cyclic diametral strain can drastically deviate from Poisson's ratio when the ratio of plastic and elastic elongation is 3 for the uncycled material. The unusual initial increase in cyclic contraction ratio for these conditions is attributed to strain concentration and the decrease to strain decentration. A condition for the unpredictable macroscopic effects is that the effective strengthening structure should be sufficiently unstable during the cyclic strain applied. At room temperature fatigue slip bands of high local density and number are created in these conditions. ESA

N88-10159# Starck (Hermann C.) Berlin, Baden (West Germany).
DEVELOPMENT AND PRODUCTION OF NEW AND MODIFIED POWDERS FOR SPRAYED COATINGS AND COMPONENTS FOR SAVING IMPORTANT RAW MATERIALS Final Report, Jun. 1985
Heinz Eschnauer, Helmut Meinhardt, and Reinhold Lutz Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1986 90 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie, West Germany
(BMFT-FB-T-86-129; ISSN-0340-7608; ETN-87-90561) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.50

Alloy systems for wear and corrosion protection were developed. Tough-hard, high chromium content composites of the type Mi-Cr-B-Si plus hard materials were investigated. These alloys, which are supplied to the users mainly as spray powders, set more stringent requirements on powder production that uses a vacuum-melt/inert-gas atomization process. The same applies to a developed high temperature solder, and alloys of the MCrAlY type. The atomizing plant was modified and improved with a view to the MCrAlY alloy, so that spray powders can be produced which fulfil aircraft industry specifications. ESA

N88-10160# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.
TRANSIENT ABSORPTION BEHAVIOR OF METALS AT THE ONSET OF THE LASER WELDING PROCESS
Martin Schellhorn Jan. 1987 44 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-12; ISSN-0171-1342; ETN-87-90596) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 18

Transition from at first poor to nearly total coupling of the CO2 laser radiation in the metal observed above a critical power density was analyzed experimentally, and with a theoretical model simulating the time dependent formation of the surface of a keyhole. By consideration of multiple reflections of the laser radiation at the wall of the keyhole the time dependent behavior of the absorption is computed. The good agreement with the measurements shows that multiple reflections of the laser radiation in the keyhole give a major contribution to the enhanced coupling. ESA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N88-10161 British Petroleum Co. Ltd., London (England).
NOVEL POLYMERS AND COPOLYMERS AND PRODUCTION OF POLY(ACETYLENE) Patent Application
William James Feast, inventor and Jeremy Nicholas Winter, inventor 5 Mar. 1986 19 p Filed 1 Aug. 1985 Priority 4 Aug. 1984 GB 8419949, 25 Aug. 1984 GB 8421643, 8 Sep. 1984 GB 8422743
(EP-Patent-0-173-473-A2; EP-Patent-Appl-SN-85305492.2; Int-Patent-Class-C08G-61/08; ETN-87-98630) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

Polymers and copolymers containing the monomer 3,6-bis(trifluoromethyl)pentacyclo (6.2.0.0(2,4).0(3,6).0(5,7)) dec-9-ene which can be easily converted into poly(acetylene) are prepared. The polymer (copolmer) and subsequent poly(acetylene) can be made into any desired shape, such as films. ESA

N88-10162 British Petroleum Co. Ltd., London (England).
A PROCESS FOR PRODUCING PHENOLIC FOAMS Patent Application
Gerald Cyril Marks, inventor, Kenneth Charles Thomas, inventor, and Per Ingmar Quist, inventor 5 Feb. 1986 13 p Filed 23 May 1985 Priority 25 May 1984 GB 8413529, 30 May 1984 GB 8413789
(EP-Patent-0-170-357-A1; EP-Patent-Appl-SN-85303656.4; Int-Patent-Class-C08J-9/14; Int-Patent-Class-C08L-61/06; ETN-87-98631) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A process for producing phenolformaldehyde (phenolic) foams is presented. Controlled combination of the components in the curing reaction mixture, and controlling the temperature within the mass of the curing mixture are described. The process is applicable to production of block or laminated foams, for use in building applications for their thermal insulation and fire resistant properties. ESA

N88-10163 British Petroleum Co. Ltd., London (England).
NOVEL CONDUCTIVE POLYMERS Patent Application
Kevin Harper, inventor and William John West Watson, inventor 28 May 1986 18 p Filed 7 Nov. 1985 Priority 17 Nov. 1984 GB 8429111
(EP-Patent-0-182-548-A2; EP-Patent-Appl-SN-85308089.3; Int-Patent-Class-C08G-75/00; ETN-87-98632) Avail: UK Patent Office, 25 Southampton Buildings, London WC1A 1A4, United Kingdom

Conductive thienylene and furanylene-vinyl polymers and a process for their preparation are described. The polymer can be formed into coherent films in which no voids are visible up to magnifications of up to 5000 times. The polymers have band gaps below 2 eV which makes them more suitable than conventional polyphenylene and poly(phenylene vinylene) polymers for use, e.g., in batteries. ESA

N88-10164 British Petroleum Co. Ltd., London (England).
PRESSURE SENSITIVE ADHESIVES Patent Application
John McMahon, inventor 4 Jun. 1986 11 p Filed 22 Nov. 1985 Priority 22 Nov. 1984 GB 8429519
(EP-Patent-0-183-495-A1; EP-Patent-Appl-SN-85308502.5; Int-Patent-Class-C08J-3/14; Int-Patent-Class-C08L-33/06; ETN-87-98633) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A pressure sensitive adhesive composition and a process for it are described. The adhesive contains a vinyl monomer, an acrylate monomer, an alpha, beta-unsaturated monocarboxylic acid, and a chelated metal alkoxide cross-linking agent. The adhesives retain their adhesive strength over a relatively long duration and can be supplied as a solution without loss of tackiness, peel, or shear strength. ESA

N88-10165 British Petroleum Co. Ltd., London (England).
CROSSLINKABLE ELASTOMERIC MATERIALS Patent Application
Jeffrey David Umpleby, inventor 21 May 1986 15 p Filed 30 Oct. 1985 Priority 1 Nov. 1984 GB 8427615
(EP-Patent-0-181-735-A1; EP-Patent-Appl-SN-85307846.7; Int-Patent-Class-C08G-81/02; Int-Patent-Class-C08K-5/54; Int-Patent-Class-C08L-9/02; ETN-87-98636) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A process for the production of a cross linkable thermoplastic elastomeric material is described. It comprises blending together under conditions which promote graft copolymerization components comprising a nitrile rubber component and a thermoplastic organic polymer component comprising, for example, ethylene/alkyl (meth)acrylate wherein the thermoplastic organic component has pendant silane groups bearing hydrolysable functions or, simultaneously with, or subsequent to, the blending/graft copolymerization, pendant silane substituents are introduced into the blend. The cross linkable thermoplastic elastomeric material can be used to manufacture articles by thermoforming. ESA

N88-10166 British Petroleum Co. Ltd., London (England).
BORONIUM COMPLEXES AS POLYMER CATALYSTS Patent Application
Kaneyoshi Ashida, inventor 15 Jan. 1986 8 p Filed 11 Jun. 1985 Priority 12 Jun. 1984 US 619857
(GB-Patent-2-161-475-A; GB-Patent-Appl-SN-8514683; Int-Patent-Class-C07F-5/02; Int-Patent-Class-B01J-31/22; Int-Patent-Class-C08G-18/16; ETN-87-98637) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

Compounds which are salts of the formula A(+) B(-) where A(+) is a quaternary ammonium cation and B(-) is a tetrahedral boron-oxygen complex anion, are prepared from boric acid by reaction with a hydroxyl compound and a quaternary ammonium hydroxide. The salts are used as catalysts to prepare carbodimides and isocyanurates from isocyanates, which can be in the form of foamed resins. ESA

N88-10167 British Petroleum Co. Ltd., London (England).
AMORPHOUS OR MICROCRYSTALLINE SEMICONDUCTOR MEMORY DEVICE Patent Application
Peter John Hockley, inventor and Michael John Thwaites, inventor 27 Nov. 1985 16 p Filed 3 Jan. 1985 Priority 13 Jan. 1984 GB 8400959
(EP-Patent-0-162-529-A1; EP-Patent-Appl-SN-85300039.6; Int-Patent-Class-H01L-29/32; Int-Patent-Class-H01L 29/86; ETN-87-98639) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A semiconductor structure suitable for making a nonvolatile memory is presented. It comprises an electrically conducting substrate, at least two layers of different conductivity type selected from i, p, and n-type amorphous or microcrystalline semiconducting material, and an additional defect layer of amorphous or microcrystalline semiconductor material located between two of the different layers. The defect layer reduces the voltage required to transform the structure to a memory device. ESA

N88-10168# Purdue Univ., West Lafayette, Ind. Dept. of Chemistry.
HIGH IONIC CONDUCTIVITY IN PEO.PPG BLOCK POLYMER AND SALT SOLUTIONS Technical Report, Mar. 1984 - Feb. 1987
Rongjian Xue and C. A. Angell Aug. 1987 15 p Submitted for publication
(Contract N00014-84-K-0289)
(AD-A183502; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07B

The conductivity of LiI dissolved in a block copolymer of polypropylene and polyethylene glycol sections of comparable length has been measured and found greater than for either of the pure polymer solutions. The composition of maximum conductivity occurs at low concentration as predicted from entropy theories in which the salt mainly serves to raise the glass transition temperature. A VTF equation gives a good description of the temperature dependence at high salt concentrations. At low concentrations, however, complications due to redistribution of salt between the distinct microregions of the microscopically segregated block units, causes a complex temperature dependence. At intermediate compositions two distinct glass transitions are observed. These blend into a single transition as the microregions blend at high salt concentrations. GRA

N88-10169# Brunel Univ., Uxbridge (England). Dept. of Materials Technology.

THE WATER ABSORPTION OF MODEL EPOXY RESIN NETWORKS CURED WITH AROMATIC DIAMINES Final Report

C. H. Lau 4 Jun. 1987 18 p

(Contract D/ERI/9/4/2066/021-XR-MAT)

(BR100722; ETN-87-90683) Avail: NTIS HC A03/MF A01

The water absorption of epoxy resin TGDDM, upon which many commercial epoxy resins used as matrices for composites in aerospace applications are based, was followed in relation to the resin's crosslink density. The water absorption and other properties of TGDDM system, cured epoxy resins of controlled crosslink density were produced by mixing the tetrafunctional TGDDM with one of two difunctional analogs, in specific ratios, so that the functionality of the blends varied between two and four. It appears that the water absorption of a resin is the product of a combination of contributory factors which may vary from system to system, depending upon the individual resin chemistries and the curing schedules. ESA

N88-10170# Defence Research Information Centre, Orpington (England).

ULTRASONIC EXAMINATION OF HIGH PERFORMANCE POLYMER COMPOSITES

F. Guttner, R. Limpert, and U. Steinhoff Jun. 1987 32 p Transl. into ENGLISH from Zeitschrift fuer Werkstofftechnik (West Germany), v. 17, no. 4, 1986 p 135-147 Original language document was announced in IAA as A86-46245

(DRIC-T-7862; BR102635; ETN-87-90693) Copyright Avail: NTIS HC A03/MF A01

Ultrasonic examination of polymer composites with the computer aided test system ABAKUS is outlined. Hardware and software are described. It is shown that the test frequency is one of the important parameters. When using the through transmission technique under water, a high sensitivity is obtainable by masking the receiving probe. The interpretation of the results becomes easier by image treatment with the software module GMANI. The goal is a fully automated evaluation. ESA

N88-10171# Argonne National Lab., Ill.

X-RAY TOMOGRAPHY AND NUCLEAR MAGNETIC RESONANCE IMAGING APPLICATIONS FOR ADVANCED CERAMIC MATERIALS

W. A. Ellingson, B. D. Sawicka, R. J. Kritz, S. Gronemeyer, and J. L. Ackerman Feb. 1987 33 p Presented at the 89th Annual Meeting of the American Ceramic Society, Pittsburgh, Pa., 26 Apr. 1987 Prepared in cooperation with Atomic Energy of Canada Ltd., Chalk River, Ontario, Illinois Univ., Chicago, Massachusetts General Hospital, Boston and Harvard Medical School, Boston, Mass.

(Contract W-31-109-eng-38)

(DE87-011534; CONF-870422-8) Avail: NTIS HC A03/MF A01

Advanced nondestructive evaluation methods are being developed to characterize ceramic materials and allow improvement of process technology. If one can determine porosity, map organic binder/plasticizer distributions, through-volume density, and detect inclusions, machine operations can then be modified to enhance the reliability of ceramics. Two modes of X-ray tomographic imaging - advanced film tomography and computed tomography - are being developed to provide flaw detection and density profile mapping capability. Nuclear magnetic resonance imaging is being developed to determine porosity and map organic binder/plasticizer distribution. Results obtained with these methods are presented. DOE

N88-10172# Sandia National Labs., Albuquerque, N. Mex.

STRUCTURE OF SOL-GEL-DERIVED INORGANIC POLYMERS. 2: SILICATES AND BORATES

C. J. Brinker, B. C. Bunker, D. R. Tallant, K. J. Ward, and R. J. Kirkpatrick 1987 22 p Presented at the 193rd National Meeting of the American Chemical Society, Denver, Colo., 5 Apr. 1987 Prepared in cooperation with Illinois Univ., Urbana

(Contract DE-AC04-76DP-00789)

(DE87-013068; SAND-87-1894C-2; CONF-870410-36) Avail: NTIS HC A03/MF A01

Many of the structural features of sol-gel-derived inorganic polymers are rationalized on the basis of the stability of the M-O-M condensation products in their synthesis environments. Structures which emerge in solution reflect a successive series of hydrolysis, condensation and, depending on the acid or base concentration, restructuring reactions. M-O-M bonds which are unstable with respect to hydrolysis or alcoholysis are generally absent. During consolidation, the condensation process continues within a very stiff matrix in a relatively inert environment. Under these conditions, metastable species may form which are temporarily stabilized by the high matrix viscosity and the absence of water and alcohol. DOE

N88-10173# Brookhaven National Lab., Upton, N. Y.

POLYITACONIC ACID MACROMOLECULE PRIMER FOR ADHESIVE BONDING AND CORROSION CONTROL OF ALUMINUM

T. Sugama, L. E. Kukacka, and N. Carciello May 1987 15 p Presented at the Tri-Service Corrosion Conference, Colorado Springs, Colo., 5 May 1987

(Contract DE-AC02-76CH-00016)

(DE87-013306; BNL-39985; CONF-8705171-1) Avail: NTIS HC A03/MF A01

When polyitaconic acid (PIA) macromolecules are applied as water-soluble primers in polyurethane (PU) adhesive/aluminum adherend joint systems, they interact preferentially with the hydrated oxide aluminum to form hydrogen bonds, and with the isocyanate groups in the adhesive to yield polymer-to-polymer chemical bonding. This chemical coupling between the adhesive and adherend acts significantly to promote interfacial adhesive bonds. The arrangement of a near monolayer of PIA intermediate film plays a key role in governing the adhesion durability of the joint system and the corrosion resistance of the aluminum upon exposure to corrosive fluids. The bond stability and the corrosion resistance are due primarily to the formation of interfacial reaction products which are less susceptible to hydrolysis. DOE

N88-10174# Princeton Univ., N. J. Dept. of Chemical Engineering.

POLYMER CHAIN SEGMENT ORIENTATION DURING STRESS RELAXATION

R. K. Prudhomme and J. T. Koberstein Jul. 1987 21 p

(Contract DE-FG02-84ER-45105)

(DE87-013392; DOE/ER-45105/T1) Avail: NTIS HC A03/MF A01

This report presents results on simultaneous measurement of stress and molecular orientation on uniaxially stretched polymer films. Stress is measured using a force transducer and orientation using infrared dichroism. A set of deuterated polystyrene samples were prepared with deuterated blocks at either the center or ends of the polymer chains. Using infrared bands, unique to the deuterated or hydrogenated sample, the relaxation of ends versus middle of the polymer chain can be monitored. The essential feature of the reptation models is that relaxation occurs from the ends of the chains first. Experimental results show: relaxation of the chain ends is more rapid than relaxation of the central portion of the

chain, orientation of the chain ends increases linearly with total elongational strain, orientation increases with polymer molecular weight, and the relaxation of overall chain orientation at long times follows stress relaxation, which is in agreement with the classical stress-optical law. DOE

N88-10175# Sandia National Labs., Albuquerque, N. Mex.
ION-IMPLANTATION-INDUCED STRESS IN GLASSES: VARIATION OF DAMAGE MODE EFFICIENCY WITH CHANGES IN GLASS STRUCTURE
G. W. Arnold 1987 14 p Presented at the Radiation Effects in Insulators-4 Conference, Lyon, France, 6 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-013523; SAND-87-0910C; CONF-870783-3) Avail: NTIS HC A03/MF A01

Ion implantation induces lateral stress in glass due to the volume dilatation in the implanted near-surface region. Cantilever-beam experiments allow these quantities to be measured as a function of fluence. For fused silica the stress data for various incident ions are found to scale with atomic collision energy deposition. In sharp contrast, Pyrex (alkali-borosilicate) glass, (1-x)(Na,K)2O(xB2O3)(3SiO2) glass, and a soda-lime (microscope slide) glass, yield stress values which scale with energy deposition into electronic processes. More significantly, this mode of damage production is dominant for the nuclear waste glasses PNL 76-68 and SRP. The void space in fused silica allows room for displaced Si and/or O. For the complex alkali-containing silicates, the interstitial volume is restricted. In the latter case, the probability increases that permanent defects can be formed by ionization-induced bond-breaking and network relaxation. These data imply that alpha-particle ionization energy deposition may be an important factor in nuclear waste glass radiation damage production, but the magnitude of this contribution has not yet been evaluated. DOE

N88-10176# Ames Lab., Iowa.
USE OF SOL-GELS IN THE APPLICATION OF CERAMIC OXIDE THIN FILMS Ph.D. Thesis
B. A. Paulson Aug. 1987 93 p
(Contract W-7405-eng-82)
(DE87-013610; IS-T-1336) Avail: NTIS HC A05/MF A01

Single component sols were characterized and used to make thin films on silicon wafers. The empirical equation, d = (2000 log (mu) + 350)(w)/sup -0.5/, was obtained, which adequately describes the thickness of the sintered films, independent of the ceramic oxide, solvent, concentration, sol age, and reaction conditions. The single component sols were used to make binary oxide sols - barium titanate, lithium niobate, and lithium tantalate. A barium solution can be added to the titania sol to produce a barium titanate compound of the desired composition, including Ba2Ti9O20 and BaTi5O11. Mixing a lithium solution into either a niobia or a tantala sol yielded the desired compound along with a heavy metal oxide (either lithium niobate with niobium oxide or lithium tantalate with tantalum oxide). However, dissolving lithium methoxide with the ethoxide of niobium or tantalum in ethanol, prior to hyrolysis, did produce the desired binary oxide (lithium niobate or lithium tantalate) without any uncombined metal oxide. By altering the stoichiometric ratios of the constituent cations, different compounds were produced for dielectric characterization with an ac bridge circuit. In the case of the barium titanates, these calculated constants ranged from a high of 26.0 for TiO2, to a low of 11.9 for BaTi5O11. The range for lithium tantalate was from a high of 21.6 for a stoichimetry of Li7TaO6, to a low at 8.4 for LiTaO3. Lithium niobate ranged from a high at 21.1 for Nb2O5, to a low at 8.9 for Nb2O5 at a stoichimetry of Li2Nb32O81. DOE

N88-10177# Japan Atomic Energy Research Inst., Tokyo.
LOW CYCLE FATIGUE ON ISOTROPIC FINE-GRAINED GRAPHITE
S. Ishiyama and T. Oku Oct. 1986 32 p In JAPANESE
(DE87-702627; JAERI-M-86-145) Avail: NTIS (US Sales Only) HC A03/MF A01

Low cyclic fatigue tests of isotropic fine-grained graphite IG-11 were performed at the stress ratio of 0.5, 0.0, -1.0, -3.5, + infinity 1/0.7, 1/0.3. The best fitting S-N curves obtained by several statistic analysis methods were compared and the effects of stress ratio and specimen size on fatigue strength were discussed and the following conclusions were obtained: (1) The best fitting S-N curve obtained by Price's method showed comparatively better in data fitting than the other methods. (2) The fatigue strength decreased as the decrease of stress ratio. The drastic decrease of fatigue strength was observed in the case of R = -3.5. The reason is that the effect of pre-compressive stress in first fatigue cycle induces the decrease of tensile strength. (3) The effect of specimen size on fatigue strength in the case of R = + infinity was due to the dependence of static strength and the process of fatigue damage on specimen size. (4) The mechanism of fatigue in graphite was well understood assuming that fatigue fracture of graphites occurred when the stress intensity factor reach the fracture toughness value in the process of crack extension. DOE

N88-10178# Universidade Federal de Sao Carlos (Brazil). Dept. de Engenharia de Materiais.
TOUGHENING OF ALPHA-ALUMINA: PRELIMINARY RESULTS
D. M. P. F. Souza, J. R. Casarini, N. Moreira, and M. Pegolo 1987 10 p In PORTUGUESE; ENGLISH summary
(DE87-702776; INIS-BR-668) Avail: NTIS (US Sales Only) HC A02/MF A01

The results of ceramic processing of aluminum hydroxide and zirconia partially stabilized with yttria are presented. DOE

N88-10179# Sandia National Labs., Albuquerque, N. Mex.
BEHAVIOR OF GRAPHITES UNDER INTENSE HEAT LOADS
J. Bohdansky, C. D. Croessmann, and J. Linke 1986 7 p Presented at the 14th SOFT - Symposium on Fusion Technology, Avignon, France, 8 Sep. 1986
(Contract DE-AC04-76DP-00789)
(DE87-012128; SAND-87-1688C; CONF-860917-22) Avail: NTIS HC A02

Today, graphite is used in most tokamak experiments as a first wall material (e.g., limiters, collector plates, amor-tiles) due to its excellent thermal shock resistance, low-Z mass, and high sublimation temperature. On the other hand, due to the high porosity gas, absorption can create a severe problem. Besides outgassing, chemical erosion and sublimation can also contribute to impurity introduction into the plasma. In this experiment the behavior of graphitic materials (fine-grain reactor grade graphites, carbon fiber composite materials, etc.) has been tested under high heat loads. More emphasis was laid on the following aspects: thermomechanical properties (cracking behavior); thermal erosion behavior (weight loss, surface modifications); and outgassing behavior (25 to 1600°C). DOE

N88-10180# Lawrence Livermore National Lab., Calif.
THEORY OF THE CARBON PHASE DIAGRAM AT HIGH PRESSURES AND TEMPERATURES
D. A. Young and R. Grover Jul. 1987 6 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-48)
(DE87-012245; UCRL-96435; CONF-870753-20) Avail: NTIS HC A02

Despite the great technological and scientific importance of graphite and diamond, the carbon phase diagram is poorly understood. Developed here is a simple theoretical model for the prediction of this diagram at very high pressures. The diamond melting curve has a positive dP/dT slope, and that solid diamond has a very large stability field. DOE

N88-10181# Vanderbilt Univ., Nashville, Tenn.
Si - SiO2 INTERFACES: A HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPY (HRTEM) STUDY
N. M. Ravindra, D. Fathy, O. W. Holland, and J. Narayan 1987 8 p Presented at the Meeting on the Physics and Technology of

Amorphous SiO/sub 2/, Les Arcs, France, 29 Jun. 1987 Prepared in cooperation with ORNL, Tenn. and North Carolina State Univ., Raleigh
(Contract DE-AC05-84OR-21400)
(DE87-012255; CONF-8706171-1) Avail: NTIS HC A02/MF A01

A High Resolution Transmission Electron Microscopy (HRTEM) study of the Si-SiO interfaces is reported here. The study has been carried out on the thermal oxidation of: (1) Si, and (2) Ge implanted Si. Evolution of the Si-SiO interface with oxide thickness and the presence of small amounts of Ge, i.e., one mono-layer at the interface and its influence on the oxidation kinetics is discussed. DOE

N88-10182# Advanced Research and Applications Corp., Sunnyvale, Calif.
CONSTRUCTION AND CHARACTERIZATION OF AMORPHOUS-SILICON TEST STRUCTURES
L. N. Koppel and A. A. Milgram Aug. 1987 29 p
(Contract W-7405-eng-36)
(DE87-013595; DOE/NBM-7013595; ARACOR/TR-524-01)
Avail: NTIS HC A03/MF A01

The central goal of the project was to qualify amorphous silicon, a newly developed semiconductor material, as the basis for economical large-area photoconductive detectors of penetrating radiation. The thrust of the project was to establish the feasibility of constructing photoconductive amorphous-silicon devices whose electronic properties supported the radiation detection application. This issue of feasibility was successfully resolved by construction and experimental characterization of amorphous-silicon test pieces representative of the existing state-of-the-art. The focus of this work was the measurement of material electronic properties known to affect the performance of solid-state radiation detectors, and the investigation of candidate junction-device architectures. DOE

N88-10183# Massachusetts Inst. of Tech., Cambridge. Ceramics Processing Research Lab.
PHYSICS AND CHEMISTRY OF PACKING FINE CERAMIC POWDERS Final Report, 1 Jan. 1981 - 30 Jun. 1986
H. K. Bowen 1986 11 p
(Contract DE-AC02-80ER-10588)
(DE87-013709; DOE/ER-10588/T1) Avail: NTIS HC A03/MF A01

The following were studied: formation and compaction of monosized silica; synthesis, characterization, and sintering of TiO powders; ordered packing and osmotic pressure of SiO; synthesis and surface chemistry of Si and SiC powders; particle interactions; and polydispersity in ceramic suspensions. DOE

N88-10184# University of Southern California, Los Angeles.
LASER CHEMICALLY VAPOR DEPOSITED SILICON-CARBIDE: GROWTH FEATURES, TOPOGRAPHY, MICROSTRUCTURE, AND COMPOSITION Ph.D. Thesis. Final Report
F. Shaapur May 1987 119 p
(Contract DE-FG03-84ER-45093)
(DE87-013767; DOE/ER-45093/T2) Avail: NTIS HC A06

Laser chemically vapor deposited SiC films were formed on SiO2, Si, and SiC substrates from monomethyl dichlorosilane (CH3SiHCl2) or mixtures of SiH4 and CH4. The depositing laser wavelength was chosen such that the reactants were transparent and the substrates absorptive, including the 9.27 and 10.6 micron lines of the CO2 laser and 514 nm line of the Ar(+) laser. Deposition rates as high as 2.25 mm/s measured for the Si/Ar+/CH3SiHCl2 system were attributed to an enhanced growth phenomenon. In the case of deposition on SiC substrate, a linear behavior was observed. The reflectivity and absorptivity of hot pressed SiC material used as a substrate in these experiments was measured in support of heat flow analysis. A new experimental technique was devised by which the accuracy of the heat flow model predictions was verified. The films were characterized by scanning electron microscopy, electron diffraction analysis, and energy dispersive and wavelength dispersive analyses. Deposited material in general consisted of fine-grained polycrystalline phases of SiC, Si, and C with the grain size ranging from 200 to 3500 A for deposition on SiC and SiO substrates, respectively. Spontaneous periodic surface structures observed on deposits from the SiC/CO2/SiH4 + CH4 system were explained via a new theory. DOE

N88-10185# Oak Ridge National Lab., Tenn.
CERAMIC COMPOSITES BY CHEMICAL VAPOR INFILTRATION INFILTRATION
D. P. Stinton 18 Oct. 1987 14 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE87-009128; CONF-871027-6) Avail: NTIS HC A03/MF A01

Composites consisting of silicon carbide matrices reinforced with continuous ceramic fibers are being developed for high-temperature structural applications. Chemical vapor deposition (CVD) techniques are very effective in fabricating composites with high strengths and exceptional fracture toughness. Mechanical properties of infiltrated composites are controlled by the strength of the interfacial bond between the fibers and matrix. This paper describes two CVD techniques and reviews the models being developed to better understand and control the infiltration process. DOE

N88-10186# Brookhaven National Lab., Upton, N. Y.
ADHESION PROPERTIES OF POLYELECTROLYTE-CHEMISORBED ZINC PHOSPHATE CONVERSION COATINGS
T. Sugama May 1987 38 p Presented at the 193rd National Meeting of the American Chemical Society, Denver, Colo., 5 Apr. 1987
(Contract DE-AC02-76CH-00016)
(DE87-012489; BNL-39873; CONF-870410-14-Rev) Avail: NTIS HC A03/MF A01

The outermost surface sites of polyelectrolyte complexed crystalline zinc phosphate (Zn.Ph) layers precipitated on cold-rolled steel surfaces act significantly to promote interfacial adhesive bonding to polymeric topcoats. This is the result of electrostatic internal diffusion and segmental chemisorption mechanisms of polyelectrolyte macromolecules either on newly precipitated crystal nuclei or on crystal growth sites during the primary Zn.Ph conversion process. The nature of the polymer-to-polymer chemical bond produced at the polymer-to-polymer complex Zn.Ph adherend interfacial joints plays the key role in the achievement of long-term bond durability upon exposure to chemically corrosive environments. DOE

N88-10187# Lawrence Livermore National Lab., Calif.
ANTI-ABRASION PROTECTION WITH HIGHLY ORGANIZED MATERIALS
W. A. Steele, H. R. Leider, and P. B. Mohr 30 Jun. 1987 7 p
(Contract W-7405-eng-48)
(DE87-014238; UCID-20839-87-2) Avail: NTIS HC A02/MF A01

Abrasion and impact resistance are a prime requirement for many materials applications. To best protect plastic or metal-based composites from abrasion and impact, a surface coating that is simultaneously very hard and highly yielding is necessary. Both these requirements can be met by a dense pattern of emergent fibers or high L/D ratios, well rooted but with one end free, i.e., hair. A covering of such hair, with fibers long enough to accommodate themselves to impacting objects, will give substantial protection against impact or particle abrasion. DOE

N88-10188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF HIGH-TEMPERATURE ANNEALING ON THE MICROSTRUCTURE AND THERMOELECTRIC PROPERTIES OF GaP DOPED SiGe M.S. Thesis
Susan L. Draper Oct. 1987 23 p
(NASA-TM-100164; E-3729; NAS 1.15:100164) Avail: NTIS HC A03/MF A01 CSCL 11G

Annealing of GaP doped SiGe will significantly alter the thermoelectric properties of the material resulting in increased performance as measured by the figure of merit Z and the power factor P. The microstructures and corresponding thermoelectric properties after annealing in the 1100 to 1300 C temperature range have been examined to correlate performance improvement with annealing history. The figure of merit and power factor were both improved by homogenizing the material and limiting the amount of cross-doping. Annealing at 1215 C for 100 hr resulted in the best combination of thermoelectric properties with a resultant figure of merit exceeding 1x10 to the -3 deg C to the -1 and a power factor of 44 microW/cm/deg C sq for the temperature range of interest for space power: 400 to 1000 C. Author

N88-10189# Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
THE INFLUENCE OF MICROVOIDS ON THE ELECTRICAL STRENGTH OF GLASS FIBER REINFORCED EPOXY RESINS Ph.D. Thesis [UEBER DEN EINFLUSS VON MIKROHOL-RAEUMEN AUF DIE ELEKTRISCHE FESTIGKEIT GLASFASER-VERSTAERKTER EPOXIDHARZ-FORMSTOFFE]
Joachim Schramm 1985 149 p In GERMAN; ENGLISH summary Sponsored by Deutschen Forschungsgeimschaft
(ETN-87-90443) Avail: NTIS HC A07/MF A01

The distribution of microvoids in unidirectionally glass fiber reinforced epoxy resins, and their effect on electrical strength were investigated. Experiments show that glass fibers may contain capillary voids which allow water or electrolytic liquids to penetrate the insulating system very quickly. These electrolytic liquids lead to a field distortion resulting in overstress in the insulation and partial discharges. A microscopic analysis of glass fiber reinforced epoxy rods reveals numerous small, isolated voids, concentrated in the edges between adjacent fibers. It is shown that no partial discharges occur in these voids, even under high stress, due to their small dimensions. The weak point is the interface between glass fibers and the resin matrix. ESA

N88-10190# Technochemie G.m.b.H., Dossenheim (West Germany).
DEVELOPMENT OF A POLYIMIDE MATRIX FOR FILAMENT WINDING WITH IMPROVED EXTENSIBILITY AND FRACTURE TOUGHNESS FOR PERMANENT USE AT 200 C Final Report, Feb. 1986
Horst Stenzenberger, Michael Herzog, Norbert Franz, and Franz Sarbacher Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1986 114 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie, West Germany
(BMFT-FB-T-86-118; ISSN-0340-7608; ETN-87-90560) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 24

Four bismaleimide resins, which can be processed by a wet filament winding process, were developed. The X1000 resin is based on conventional reactive diluents, and can be processed at 70C; however its fracture toughness is low. Three system, based on low melting eutectic bismaleimide mixtures, were formulated with allyl-phenyl-type comonomers, which provide extremely high fracture energies (350 to 700 J/sqm). These resins can be processed by a wet winding procedure employing impregnation temperatures of 100C. Measurements on NOL-rings indicate a high fiber strength use at 200C. Resins with higher extensibility and fracture toughness provide better laminate properties. High strength fiber of the type HTA-7-3000 as well as intermediate-modulus fibers are suited for the resins. ESA

N88-10191*# Akron Univ., Ohio. Advanced Materials Branch.
SYNTHESIS AND CHARACTERIZATION OF PROCESSABLE POLYIMIDES WITH ENHANCED THERMAL STABILITY Final Report, 1 Mar. 1986 - 28 Feb. 1987
Frank W. Harris 2 Oct. 1987 26 p
(Grant NAG1-448)
(NASA-CR-181447; NAS 1.26:181447) Avail: NTIS HC A03/MF A01 CSCL 11B

Many of the emerging applications of polymers on space vehicles require materials with outstanding thermal stability. These polymers must also be readily processable in order to facilitate their use. The syntheses and polymerization of a cardo dianhydride were investigated. This monomer was prepared via the reaction of N-methyl 4-nitrophthalimide with a cardo diol. Polyimides containing oxyalkylene linkages were studied. The effects of two additional structural modifications on the polymers' properties were investigated. The effects of carrying out the preparation of poly(amic acid)s under non-equilibrium conditions were examined. Approaches that were investigated included the in-situ neutralization of the generated amic acid and its in-situ esterification. B.G.

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N88-10192# Air Force Wright Aeronautical Labs., Hampton, Va.
COST SAVINGS POSSIBLE WITH AIR FORCE CONVERSION TO JP-8 AS ITS PRIMARY FUEL Summary Report, Jan. - Apr. 1987
Charles R. Martel May 1987 29 p
(AD-A183784; AFWAL-TR-87-2037) Avail: NTIS HC A03/MF A01 CSCL 05A

JP-4 has been the primary fuel for the USAF since 1951. However, in 1979 the USAF converted to JP-8 as its primary jet fuel for its operations in Great Britain. Recently, the North Atlantic Treaty Organization (NATO) began the switch from JP-4 (F40) to JP-8 (F34) as its primary jet fuel. However, JP-4 continues to be the primary USAF jet fuel within the continental United States. The cost and manpower savings possible by converting from JP-4 to JP-8, as the primary jet fuel for the Air Force, are identified and estimated. The much lower volatility of JP-8, as compared to JP-4, accounts for the anticipated savings. For example, aircraft fuel systems must be purged prior to maintenance, and purging aircraft fuel systems that have contained JP-4 can take hours to days. With JP-8 purging may not even be necessary under most ambient temperatures. Another major savings is the reduced evaporation of JP-8, as compared to the more volatile JP-4. Finally, reduced fatalities and casualty losses resulting from ground and flight accidents are estimated. GRA

N88-10193# Argonne National Lab., Ill.
PRODUCTS OF THE NEUTRALIZATION OF HYDRAZINE FUELS WITH HYPOCHLORITE, 2
K. L. Brubaker, J. Bonilla, V. C. Stamoudis, A. S. Boparai, and C. T. Snyder 1987 7 p Presented at the JANNAF Safety and Environmental Protection Subcommittee Meeting, Cleveland, Ohio, 5 May 1987
(Contract W-31-109-eng-38)
(DE87-011454; CONF-8705159-1) Avail: NTIS HC A02

Neutralization of hydrazine fuels with hypochlorite is a recommended procedure for the treatment of fuel spills prior to disposal. Previous research has shown that incomplete reaction of hypochlorite with the methylated hydrazine fuels monomethylhydrazine (MMH) and unsymmetrical dimethylhydrazine (UDMH) leads to a wide variety of byproducts, including N-nitrosoamines, which are believed to be highly carcinogenic. The results presented in this paper were obtained as part of a program to assess the environmental implications of using the hypochlorite method for the treatment and disposal of hydrazine fuel spills. The fuels examined were hydrazine, MMH, UDMH and Aerozine-50. The neutralization products were determined under experimental conditions comparable to those expected for actual spills. The effects of varying the temperature and the pH as well as of aging the final reaction mixture were determined. Quantitative measurements of the nitrosoamines produced are presented. Major

and environmentally significant minor products were identified using gas chromatography/mass-spectrometry. DOE

N88-10194# Los Alamos National Lab., N. Mex.
A STUDY OF DIVERGING DETONATION IN HIGH-EXPLOSIVE SYSTEMS
P. K. Tang 1987 6 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract W-7405-eng-36)
(DE87-006070; LA-UR-87-322; CONF-871040-1) Avail: NTIS HC A02/MF A01

Initiation of an insensitive high-explosive main charge can be achieved by using a booster. The requirement for the booster high explosive should be high sensitivity rather than high energy. Using a reactive model, this study presents the evolution of detonation in PBX-9502 main charge with two different booster materials: low-density ultrafine TATB and X-0407 in a diverging configuration. DOE

N88-10195# Los Alamos National Lab., N. Mex.
REAL TIME ANALYSIS OF DETONATION PRODUCTS
N. C. Blais, R. Greiner, and W. Fernandez 1987 8 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract W-7405-eng-36)
(DE87-007453; LA-UR-87-928; CONF-871040-3) Avail: NTIS HC A02/MF A01

We have determined the mass spectrum and the time evolution of the freely expanding products of highly shocked and detonating substances. So far we have studied pentaerythritol tetranitrate (PETN), hexanitrostilbene (HNS), cyclotrimethylene trinitranamine (RDX) and nitric oxide (NO). For the case of NO, we find that N2 and O2 are important products of the detonation. Other reaction products are N2O and NO2, some of which arise from secondary reactions between O2 and unreacted NO. The other explosives give rise to a rich spectrum that includes many radicals not found in equilibrium spectra. Comparative spectra for two of these common explosives, RDX and HNS, are presented. DOE

N88-10196# Lawrence Livermore National Lab., Calif.
SHOCK MEASUREMENTS ON EXPLOSIVES IN THE SUPRA COMPRESSIVE REGION
L. Green, N. Holmes, and J. Kury 1 Apr. 1987 8 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract W-7405-eng-48)
(DE87-008423; UCRL-95461; CONF-871040-5) Avail: NTIS HC A02/MF A01

The velocity of supra-compressive shocks in PETN and LX-14 (94% HMX/6% ESTANE) have been measured using the extinction of the reaction-generated light at free surfaces to signal shock arrival. Additional measurements were made on PETN using pin techniques. A single JWL equation was fit to the results of the supra-compressive experiments on PETN at pressures up to 80 GPa, to the measured C-J pressure, and to cylinder test data. The results are compared with theoretical calculations. DOE

N88-10197# Lawrence Livermore National Lab., Calif.
STATISTICAL MECHANICAL THEORY OF CONDENSED EXPLOSIVES
F. H. Ree and M. vanThiel 22 Apr. 1987 9 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract W-7405-eng-48)
(DE87-009137; UCRL-95818; CONF-871040-6) Avail: NTIS HC A02/MF A01

The goal of explosive research is to understand the detonation performance of explosives by using fundamental theories of physics and chemistry. The present article describes results of calculations on PBX-9494, LX-14, PETN, and TNT. DOE

N88-10198# Lawrence Livermore National Lab., Calif.
THE EFFECT OF RDX PARTICLE SIZE ON THE SHOCK SENSITIVITY OF CAST PBX FORMULATIONS. 2: BIMODAL COMPOSITIONS
H. Moulard, A. Delclos, and J. Kury 1 Apr. 1987 9 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987 Prepared in cooperation with Institut Franco-Allemand de Recherches, Saint-Louis, France and Societe Nationale des Poudres et Explosifs, Vert-le-Petit, France
(Contract W-7405-eng-48)
(DE87-009581; UCRL-95483; CONF-871040-7) Avail: NTIS HC A02/MF A01

The effect of RDX particle size on the shock sensitivity and detonation velocity of two cast polyurethane-based bimodal RDX formulations has been determined. The shock sensitivity results (wedge test data) have been interpreted using a hydrodynamic code containing a three term ignition and growth model for build-up of detonation. DOE

N88-10199# Lawrence Livermore National Lab., Calif.
OPTICALLY TIME-RESOLVED DETONATION BREAK OUT
K. Bahl, W. VonHolle, and R. S. Lee 20 May 1987 6 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract W-7405-eng-48)
(DE87-010340; UCRL-95443; CONF-871040-8) Avail: NTIS HC A02/MF A01

Optical measurements are made of detonation arrival at high explosive free surfaces in air, vacuum and in contact with potassium chloride and sodium chloride single crystals. Fast, time resolved measurements with an electronic streak camera operating at 100 mm/microsec reveal interesting luminosity histories. Bare surfaces yield sharp features which allow time of arrival measurements accurate to a few nanoseconds. An HMX-containing explosive with a relatively large particle size exhibits a clear inhomogeneity perpendicular to the sweep direction compared to PETN or TATB explosives containing finer particles. The use of electronic streak cameras has extended the range of writing speeds over those of rotating mirror cameras by an order of magnitude. This Laboratory has begun to use electronic cameras as a routine diagnostic tool for detonation phenomena. Because of their high speed and sensitivity, they are capable of extremely precise timing measurements, and this feature is used to develop an improved method for measuring detonation break out. This technique is described and the experiments designed to determine the exact nature of the observed features of the detonation break out. The time resolved light emission appears to be intimately connected with the detonation reaction zone structure, and there are significant differences between explosives. DOE

N88-10200# Sandia National Labs., Albuquerque, N. Mex.
MICROSTRUCTURAL EFFECTS IN SHOCK INITIATION OF GRANULAR EXPLOSIVES
R. E. Setchell 1987 21 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011282; SAND-86-2339C; CONF-871040-9) Avail: NTIS HC A03/MF A01

The shock sensitivity of explosives having identical chemical compositions and densities can be very different if they differ significantly in their microstructural characteristics. In the current work, the explosive hexanitrostilbene (HNS) is used to examine the effects of microstructural characteristics on shock initiation processes. Initial powders having three distinct grain-size distributions are used to press binderless pellets at a common density that is 92% of crystal density. The effects of the pressing operations are shown in grain-size distributions found for powders recovered from dispersed pellets. Planar impact techniques are used to generate sustained shock waves at pressures from 2.5 to 3.4 GPa in each type of HNS material. Laser velocity interferometry is used to observe the evolution of these waves propagating in each material. In addition, two methods for observing visible

emission from the shock-compressed explosives are used to provide more sensitive indicators of chemical reactivity. The results clearly show that the three types of HNS have fundamentally different shock initiation behaviors under the conditions examined. DOE

N88-10201# Lawrence Livermore National Lab., Calif.
CURRENT EXPERIMENTAL AND THEORETICAL UNDERSTANDING OF DETONATION WAVES IN HETEROGENEOUS SOLID EXPLOSIVES
C. M. Tarver, R. D. Breithaupt, and J. W. Kury 14 Apr. 1987 11 p Presented at the International Symposium on Pyrotechnics and Explosives, Beijing, China, 12 Oct. 1987
(Contract W-7405-eng-48)
(DE87-012177; UCRL-95462; CONF-871040-10) Avail: NTIS HC A03/MF A01

Nanosecond time resolution embedded gauge, laser interferometric, and numerical modeling techniques have been applied to detonating heterogeneous solid explosives based on HMX, TATB, TNT and PETN. These techniques combine to yield an average, one-dimensional ZND profile of the reaction zones and an estimate of the unreacted von Neumann spike state (or a partially reacted state depending on the actual time resolution of the experimental techniques and the actual initial reaction rates). Generally the new results confirm previous measurements of the spike pressure and overall reaction zone length, but they yield much more precise information on the chemical energy release rates under various experimental conditions. The relatively slow process of carbon condensation in HMX detonation is observed following rapid release of most of the chemical energy. In the longer reaction zones of TNT and TATB-based explosives, a rapid exothermic process followed by a slower exothermic process is also observed. DOE

N88-10202# Mueller Associates, Inc., Baltimore, Md.
COMPENDIUM OF SIGNIFICANT EVENTS IN THE RECENT DEVELOPMENT OF ALCOHOL FUELS IN THE UNITED STATES
R. L. Bechtold Jun. 1987 51 p
(Contract DE-AC05-84OR-21400)
(DE87-013355; ORNL/Sub-85-22007/1) Avail: NTIS HC A04/MF A01

The key events in the recent development of alcohol fuels in the United States are listed. While having historical value, this compendium may also serve as a useful reference tool in planning future alternative fuel efforts. The criteria used to determine whether an event would be mentioned in the compendium included: significant impact on the development of alcohol fuels; identification with a date or time period; and public knowledge, i.e., was it reported to the public. Many of the technical advances made to use alcohols in vehicles are not represented because they did not meet one or more of the criteria. This deficiency was recognized and it is felt that a more appropriate approach for treating technical advances would be a report written in narrative style including those achievements. While all the events included in this compendium are believed to be accurate with regard to content and chronology, no attempt was made to assess whether a given event was positive or negative to the advancement of alcohol fuels. DOE

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology*.

N88-10203# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PRELIMINARY STUDY OF A CONTAINERLESS PROCESSING FACILITY FOR COLUMBUS, EXECUTIVE SUMMARY
R. Behrle Paris, France ESA Jan. 1987 11 p
(Contract ESA-6508/85-F-FL(SC))
(ESA-ITT-AO/1-1,834/85F; ESA-CR(P)-2387; ETN-87-90520)
Avail: NTIS HC A03/MF A01

The compatibility between spaceborne heating and levitation concepts and the requirements of experiments on containerless processing with metals and glasses, measurement of material properties, crystal growth, critical point phenomena, combustion of single drops, and fluid sciences was studied. The feasibility of aerodynamic levitation up to 2200 C is questionable, even under microgravity. The development of a high temperature ZrO2-heater for space application is favored. High technological challenge is posed by two color pyrometric measurements. Operational problems are outlined. ESA

N88-10204# MATRA Espace, Toulouse (France).
PRELIMINARY STUDY OF A BIOTECHNOLOGY RESEARCH FACILITY FOR MICROGRAVITY, EXECUTIVE SUMMARY Final Report
Paris, France ESA Jan. 1987 64 p
(Contract ESA-6504/85-F-FL(SC))
(MATRA-EPT/AS/VT209/246/NT; ESA-CR(P)-2388; ETN-87-90521) Avail: NTIS HC A04/MF A01

A research laboratory for space experiments in bioproduction and bioseparation developed in a pre-Columbus flight such as Spacelab was studied. The scientific and experimental background, and the requirements of the facility in Spacelab conditions are reviewed. A design concept with selected modular and support equipment (analysis and diagnostics) including feasibility aspects as required services and accommodation, and operations is elaborated. ESA

N88-10205# MATRA Espace, Toulouse (France).
PRELIMINARY STUDY OF A GRAVITATIONAL BIOLOGY FACILITY FOR COLUMBUS, EXECUTIVE SUMMARY
Paris, France ESA 1986 174 p
(Contract ESA-6501/85-F-FL(SC))
(Matra-EPT/AS/VT209/255/NT; ESA-CR(P)-2389; ETN-87-90522)
Avail: NTIS HC A08/MF A01

The scientific and experimental background, scientific and experimental requirements, and a design concept and facility philosophy of a spaceborne biology laboratory were studied. Services required from the Columbus space station and peripheral units were assessed. Accommodation and operational aspects were investigated. ESA

N88-10206# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PREPHASE A STUDY OF A CRYSTALLIZATION LABORATORY FOR COLUMBUS, EXECUTIVE SUMMARY
R. Behrle Paris, France ESA Jan. 1987 13 p
(Contract ESA-6616/85-F-HEW(SC))
(ESA-ITT/AO/1-1866/85F; ESA-CR(P)-2399; ETN-87-90534)
Avail: NTIS HC A03/MF A01

Crystal growth techniques for organic and inorganic materials were reviewed. Experiment requirements were established. Design concepts for selected facilities were studied, emphasizing modular concepts. Diagnostics, stimuli, and accommodation aspects were investigated. ESA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N88-10207# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
COMPONENTS FOR CRYOSTAT Final Report
Paris, France ESA 6 Nov. 1986 75 p
(Contract ESTEC-6485/85-NL-PH(SC))
(MBB-ISO-TN-CD00.003,Rev.A.; ESA-CR(P)-2415; ETN-87-90555)
Avail: NTIS HC A04/MF A01

Requirements were assessed for components necessary to the management of cryogens in space cryostats, taking as primary

source the demands of the ISO liquid He cryostat. A detailed technical specification (as tables of performance, constraints, and qualification values) for the components to be developed for ISO was prepared. A detailed technical plan for the development, manufacture, testing, and qualification to the required engineering model standard of all components identified and selected was drawn up. ESA

N88-10208# Oak Ridge National Lab., Tenn.
FIBER-REINFORCED COMPOSITE HOT-GAS FILTERS
D. P. Stinton, R. A. Lowden, and R. Chang May 1987 13 p Presented at the Fossil Energy Materials Program Conference, Oak Ridge, Tenn., 19 May 1987 Prepared in cooperation with Acurex Corp., Mountain View, Calif.
(Contract DE-AC05-84OR-21400)
(DE87-012257; CONF-8705103-1) Avail: NTIS HC A03/MF A01

A chemical vapor deposition process was developed for the fabrication of high-temperature particulate filters. Fibrous materials such as Nicalon (SiC) felt and aluminosilicate papers were used as the filter material. Preliminary evaluation of filter specimens fabricated from Nicalon revealed extremely encouraging results. Cleanable filters with collection efficiencies of greater than 99.9% were recorded for both PFBC flyash and gasifier char. DOE

N88-10209# National Bureau of Standards, Gaithersburg, Md. Center for Fire Research.
TEST RESULTS AND PREDICTIONS FOR THE RESPONSE OF NEAR-CEILING SPRINKLER LINKS IN A FULL-SCALE COMPARTMENT FIRE
Leonard Y. Cooper and David W. Stroup Sep. 1987 45 p
(NBSIR-87-3633) Avail: NTIS HC A03/MF A01

Data acquired during a test program which involved full-scale, sprinklered, compartment fires is presented and analyzed. This work focuses attention specifically on key features of the typical sprinkler link deployment/response problem. It is found that the elevated temperature, upper smoke layer which develops inevitably in compartment fires can have a major impact on the thermal response of sprinkler links. It is shown that traditionally accepted methods of predicting sprinkler response which do not account for this upper layer can be totally inadequate. Link response predictions used here involve a new method of calculation which does take account of the smoke layer environment. Favorable comparisons between predictions and experiment are obtained and experiments for further validation of this method are recommended. Finally, it is found that sprinkler link-to-ceiling spacing can have a significant effect on the thermal response of links and it is recommended that a method which accounts for this effect be developed and validated. Author

N88-10210# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Kernverfahrstechnik.
FABRICATION OF MICROSTRUCTURES WITH EXTREME STRUCTURAL HEIGHTS BY VACUUM REACTION INJECTION MOLDING AND ELECTROFORMING
H. Vollmer, W. Ehrfeld, and P. Hagmann May 1987 74 p In GERMAN; ENGLISH summary
(KfK-4267; ISSN-0303-4003; ETN-87-90790) Copyright Avail: NTIS HC A04/MF A01

A vacuum reaction injection molding (RIM) process to fabricate plastic microstructures having minimum lateral dimensions in the micrometer range and structural heights of several hundred micrometers is described. The plastic structures generated by this method on an electrically conductive gate plate can be used directly as templates for the production of metallic microstructures through electroforming. The mold inserts for the molding tools used in the RIM process are fabricated by synchrotron radiation lithography and electroforming on an electrically conductive base plate. Particularly stable mold inserts made of one single material with extremely plane surfaces are obtained by electrodeposition of metal such that it stands several millimeters over the resist structures generated by lithography. The mold insert produced in this way is separated from the base plate and the resist structures are subsequently removed. ESA

N88-10211# Lawrence Livermore National Lab., Calif.
SYNERGISM OF ELECTROPLATING AND VACUUM PROCESSES
J. W. Dini 16 Apr. 1987 13 p Presented at the 1st International Society for the Advancement of Materials Process Engineers Metals and Metals Processing Conference, Cherry Hill, N.J., 18 Aug. 1987
(Contract W-7405-eng-48)
(DE87-013496; UCRL-95460; CONF-8708114-1) Avail: NTIS HC A03

Synergism can be obtained by combining electrodeposition and vacuum processes. In a number of cases, better coatings and improved adhesion can be obtained when the two processes are combined. Also, for some applications, parts that could not be fabricated by either method by itself, can be produced when the two processes are combined. A number of these examples are discussed in this paper. DOE

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N88-10212# Naval Research Lab., Washington, D.C.
ELF/VLF/LF PROPAGATION AND SYSTEM DESIGN Interim Report
Francis J. Kelly 23 Jun. 1987 126 p
(AD-A183261; NRL-9028) Avail: NTIS HC A07/MF A01 CSCL 20N

The effects of propagation conditions in the ELF/VLF/LF frequency band on the design and performance of digital communications systems are described in this report. Also, discussed in this report is the communications channel from a ground-based or airborne transmitting antenna through the Earth-ionosphere waveguide to the receiver. Questions about coverage, noise, dispersion, time variance, and propagation disturbances are also summarized here. GRA

N88-10213*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COLLECTION AND ANALYSIS OF SPECIFIC ELINT SIGNAL PARAMETERS Final Technical Memo
Lonnie A. Wilson 9 Dec. 1985 118 p
(Contract NAS7-918)
(NASA-CR-181419; NAS 1.26:181419; JPL-D-27876; JPL-UAA-016; AD-A183813; FTM-8) Avail: NTIS HC A06/MF A01 CSCL 17I

This report was a followup to, Collection and Analysis of Specific ELINT Signal Parameters, DTIC A166507, 23 June 1985. The programs and hardware assembled for the above mentioned report were used to analyze two types of radar, the PPS-6 and the HOOD radars. The typical ELINT parameters of frequency, pulse width, and pulse repetition rate were collected and analyzed. GRA

N88-10214# Stanford Univ., Calif. Center for Large Scale Scientific Computation.
INHOMOGENEOUS CONDITIONS AT OPEN BOUNDARIES FOR WAVE PROPAGATION PROBLEMS
Bertil Gustafsson Apr. 1987 19 p
(Contracts N00014-84-K-0267; N00014-82-K-0335)
(AD-A183847; CLASSIC-87-19) Avail: NTIS HC A03/MF A01 CSCL 12A

When wave propagation problems are solved numerically, it is often necessary to introduce artificial boundaries. In most cases no data are available at these boundaries, and therefore it is necessary to construct boundary conditions which in some way accounts for the behavior of the solution outside the computational domain. Hence some assumption must be made which makes it possible to solve the problem exactly outside, or alternatively to compute the solution approximately in a simple way. One such assumption is that the waves are propagating only in the outward direction across the boundary. This is the basis for various procedures in common use, the most general class being the absorbing boundary conditions. The absorbing boundary conditions of higher order are formulated in terms of differentiated functions. This leads necessarily to weakly ill-posed problems, and as a consequence also to unstable numerical methods. This has been pointed out for the scalar wave-equation. For conditions of order two or less, the possible effects of the instability is outweighed by the small reflection coefficients. This paper investigates this problem further. When the initial data do not have compact support within the computational domain, or when some outside source is present, the boundary conditions become inhomogeneous. This tends to amplify the influence of the instability, and it becomes essential to modify the boundary procedure. GRA

N88-10215# Ohio State Univ., Columbus. Electroscience Lab.
FEATURE SELECTION APPLIED TO RADAR TARGET IDENTIFICATION
Ogmundur Snorrason and F. D. Garber Jul. 1987 176 p
(Contract N00014-85-C-0321)
(AD-A183880; ESL-717220-3) Avail: NTIS HC A09/MF A01 CSCL 17I

Three feature selection algorithms are investigated and applied to characterize optimum sets of frequencies for radar target identification. One algorithm is of the nonparametric discriminant analysis type, the other two algorithms, the pairwise exponential weight distance algorithm and the pairwise probability of error algorithm, are parametric and incorporate information about the measurement noise into the feature selection process. The utility of these feature selection algorithms for radar target identification is then evaluated through Monte-Carlo simulations. It is found that significant gain in classification performance can be achieved by using the optimum sets of frequencies characterized by the parametric algorithms. GRA

N88-10216 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
REALIZATION OF A CONICAL FOUR-PART ANTENNA FOR THE SCANNING OF INTERFERENCE FIELDS [REALISIERUNG EINER KONISCHEN 4-TOR-ANTENNE ZUR ABTASTUNG EBENER INTERFERENZFELDER]
W. Soentgerath and Chr. vonWinterfeld Dec. 1986 21 p In GERMAN; ENGLISH summary
(Contract BMVg-FOA-T/RF-31/D0037/D1332)
(Rept-13-86; LFD-257; ETN-87-90394) Copyright Avail: Issuing Activity

A four-port antenna with conical aperture was built and tested, for the analysis of interference of plane waves. The construction of the conical antenna system and the feeding system are described. The required farfield input diagrams are approximately obtained in a narrow angular region around the cone axis. Sum and difference patterns with two orthogonal polarizations are realized near the normal direction. The principal suitability of the antenna for tracking with few polarization-errors is demonstrated with an algorithm. The diagrams could be improved, e.g., by more antenna elements in the conical aperture. ESA

N88-10217# LABEN Space Instrumentation and Systems, Milan (Italy).
DESIGN, MANUFACTURE AND TESTING OF AN ELEGANT BREADBOARD MODEL COMMUNICATIONS PROCESSOR Final Report
P. Brusaferri Paris, France ESA Sep. 1986 272 p
(Contract ESTEC-5704/83)
(D/2244; ESA-CR(P)-2384; ETN-87-90519) Avail: NTIS HC A12/MF A01

A communications processor to handle networking within the on-board data handling system was developed. It facilitates packet telemetry (IM) and packet telecommand (TC) for the transmission of space acquired data, from spaceborne source to a user on ground, and of data sets from a ground source to a spaceborne user in a standardized and highly automated way. The layered approach used to model the communications is proved very useful. Use of VLSI components developed elsewhere is validated, allowing miniaturization of the unit. The consistency and the efficiency of the packet TM and packet TC standard introduced is confirmed. ESA

N88-10218# Technische Univ., Vienna (Austria). Inst. fuer Nachrichtentechnik.
COHERENT INFRARED DETECTION, VOLUME B Final Report
Walter R. Leeb, Arpad L. Scholtz, Heinz K. Philipp, and Reinhold Flatscher Paris, France ESA 31 Jan. 1987 175 p
(Contract ESTEC-5584/83-NL-PR)
(ESA-CR(P)-2392-Vol-1; ETN-87-90526) Avail: NTIS HC A07/MF A01

A 10 micron homodyne receiver model for infrared detection was developed. The receiver front end is a dc-coupled optical phase-locked loop (PLL). It performs the phase synchronization of the CO2 laser serving as local oscillator and the demodulation of the data which are phase-shift-keyed at 140Mbit/sec. Subnanowatt sensitivity is demonstrated. Microprocessor-aided dc-offset compensation proves advantageous, but time delay within the PLL caused by the acousto-optic frequency shifter and the existence of residual spectral lines in the local oscillator laser beam limit the sensitivity of the experimental setup. ESA

N88-10219# Technische Univ., Vienna (Austria). Inst. fuer Nachrichtentechnik.
COHERENT INFRARED DETECTION, VOLUME D Final Report
Alexandru F. Popescu, Walter R. Leeb, and Arpad L. Scholtz Paris, France ESA 29 Nov. 1986 177 p
(Contract ESTEC-5584/83-NL-PR)
(ESA-CR(P)-2392-Vol-2; ETN-87-90527) Avail: NTIS HC A09/MF A01

The design, development, and testing of a laboratory model of a bidirectional, semiconductor laser data link package to demonstrate pointing, acquisition, and tracking and bidirectional data transmission at 1 mW optical power level are described. The system consists of 2 independent terminals 20 m apart. For bidirectional data transmission wavelength division multiplexing at 0.85 and 1.3 microns is used. The 0.85 micron beam carries a 10Mbit/sec data stream, while the beacon beam at 1.3 microns transmits a low-data-rate signal at 160kbit/sec. Direct detection is implemented in both terminals. One transceiver is mounted on a test jig which permits transverse movement over an area of 1mx1m at a speed of up to 10cm/sec. For a field of uncertainty of 2.5 deg x 2.5 deg, acquisition times less than 10 sec are obtained. Tracking accuracies better than 150 microrad are measured. The tracking capability is demonstrated for transverse transceiver movement with speeds of up to 10cm/sec (corresponding to an angular speed pf 0.25 deg/sec). ESA

N88-10220# Italspazio, Rome (Italy).
STUDY OF MOBILE COMMUNICATIONS PAYLOAD FOR COLUMBUS POLAR PLATFORMS Final Report
A. Cramarossa, A. DeNinno, P. Palmucci, A. Pandolfi, V. Piloni, G. Rondinelli, and A. Tuozzi Paris, France ESA Dec. 1986 38 p
(Contract ESA-6606/85-F-RD(SC))
(ITS-TR-056A/86; ESA-CR(P)-2396; ETN-87-90530) Avail: NTIS HC A03/MF A01

A communication payload to be embarked on the Polar Platform of the Columbus program, to provide mobile communications services to the polar areas was defined. The time visibility constraints typical of the low altitude orbit of the platform are experienced by users and therefore limit the possibilities of real

time operation. However, mail box type communications may be successfully implemented. The system architecture for a low orbit polar platform and the criteria for real time and mail box operations were derived. The system architecture includes the Earth segment and the in-orbit system. Problems relevant to the real viability of the in-orbit system were investigated, defining the service operation conditions and the communications transponder layout. The user terminal architecture was assessed to demonstrate overall program feasibility. ESA

N88-10221# Admiralty Research Establishment, Portland (England).
POWER FLOW IN TERMS OF POYNTING VECTOR FOR EXTREMELY LOW FREQUENCY (ELF) DIPOLE SOURCES IN SEAWATER
G. W. Garnett Mar. 1987 16 p
(ARE-TM(UTM)87102; ACCN-75129; BR102409; ETN-87-90686)
Copyright Avail: NTIS HC A03/MF A01

Power flow in the electromagnetic field of a horizontal electric dipole source is analyzed in terms of the real part of the complex Poynting vector. Results for extremely low frequency sources embedded in a two-layer conducting half-space consisting of seawater and seabed were computed. Bending of the power flow lines at boundaries between different media is related to the different modes of propagation. Comparison with similar effects found at radio frequencies in a lossy ground is made. ESA

N88-10222# Royal Signals and Radar Establishment, Malvern (England).
A COMPACT DIGITAL COMMUNICATIONS SYSTEM. PART 3: GENERALISING THE PHASE LOCKED LOOP
J. A. S. Pritchard Apr. 1987 47 p
(RSRE-Memo-4027-Pt-3; BR102288; ETN-87-90694) Copyright
Avail: NTIS HC A03/MF A01

A generalization of the phase locked loop principle which eliminates the problem of carrier recovery when applied to phase shift signals is described. The system is tolerant of signal fading and shows orders of magnitude improvements in pull-in range and tracking performance over systems used in satcoms. Pull-in range exceeds 150 Hz in an absolute signal to noise ratio of worse than -10 dB. The loop tracks a 50 Baud PSK modulated carrier shifting at greater than 300 Hz/sec. ESA

N88-10223# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
AUTOMATION STRATEGY AND RESULTS FOR AN AIRBASE COMMAND AND CONTROL INFORMATION SYSTEM
R. P. deMoel and W. N. vanDranen (Royal Netherlands Air Force, The Hague.) 5 Jan. 1986 22 p Presented at the Spring 1986 Avionics Panel Symposium on Advanced Computer Aids in Air Warfare and Ground Strike Operations, Kongsberg, Norway, 12-16 May 1986
(NLR-MP-86031-U; ACIV/540/86; B8701679; ETN-87-90827)
Avail: NTIS HC A03/MF A01

Automation of the information supply for command and control for the preparation and deployment of weapons systems at airbases is discussed. The experiments in the operational environment prove that the use of automation tools with respect to information supply improves the integrity of the information and facilitates mission preparation. Bottlenecks with respect to the vulnerability characteristics of computers must be eliminated to improve the resistance of electronic information system. Automation offers more possibilities to improve the information handling rate, especially the extension of the decision and information handling support; condensation and upgrading of information; and knowledge engineering. ESA

N88-10224 Pennsylvania Univ., Philadelphia.
CROSSTALK IN BRAIDED SHIELD COAXIAL CABLES Ph.D. Thesis
Steven J. Peters 1987 292 p
Avail: Univ. Microfilms Order No. DA8714108

The phenomenon of crosstalk between parallel braided shield coaxial cables is examined. Two specific configurations are treated in detail: (1) two infinite length cables; and (2) two finite length cables with their shields terminated in perfectly conducting shorting planes. Crosstalk is calculated using a new integral equation formulation. A comparison is made between the existing transmission line model traditionally used for analyzing such coupling and this new approach. Measurements of far-end and near-end crosstalk were made and the correlation of this data with these two theories is discussed. It was found that, at frequencies such that the cable separation is an appreciable portion of a wavelength, the integral equation approach is much more accurate at predicting the crosstalk than transmission line theory. Dissert. Abstr.

N88-10225# Lawrence Livermore National Lab., Calif.
THEORY OF ATOMS IN STRONG, PULSED ELECTROMAGNETIC FIELDS. 2: A FREE ELECTRON AND A HARMONICALLY BOUND ELECTRON
A. Szoeke and J. Garrison Jul. 1987 25 p
(Contract W-7405-eng-48)
(DE87-012571; UCID-21103) Avail: NTIS HC A03/MF A01

Multiple scale methods are used to treat several ingredients of the theory of atoms in strong electromagnetic fields. First, a focused electromagnetic field is expanded. Second, a classical electron is described giving the ponderomotive potential. Third, the quantum electron is treated in the WKB approximation. Fourth, the one dimensional quantum harmonic oscillator is solved. Lastly, the one dimensional square well, showing the low intensity limit of the theory, is discussed. DOE

N88-10226# Sandia National Labs., Albuquerque, N. Mex.
ANECHOIC CHAMBER TEST OF THE ELECTROMAGNETIC MEASUREMENT SYSTEM GROUND TEST UNIT
L. E. Stevenson, L. D. Scott, and E. T. Oakes 10 Apr. 1987 50 p
(Contract DE-AC04-76DP-00789)
(DE87-012998; SAND-87-1379) Avail: NTIS HC A03/MF A01

The Electromagnetic Measurement System (EMMS) will acquire data on electromagnetic (EM) environments at key weapon locations on various aircraft certified for nuclear weapons. The high-frequency ground unit of the EMMS consists of an instrumented B61 bomb case that will measure (with current probes) the localized current density resulting from an applied EM field. For this portion of the EMMS, the first system test was performed in the Anechoic Chamber Facility at Sandia National Laboratories, Albuquerque, New Mexico. The EMMS pod was subjected to EM radiation at microwave frequencies of 1, 3, and 10 GHz. At each frequency, the EMMS pod was rotated at many positions relative to the microwave source so that the individual current probes were exposed to a direct line-of-sight illumination. The variations between the measured and calculated electric fields for the current probes with direct illumination by the EM source are within a few db. The results obtained from the anechoic test were better than expected and verify that the high frequency ground portion of the EMMS will accurately measure the EM environments for which it was designed. DOE

N88-10227# Lawrence Livermore National Lab., Calif.
THE POLARIZATION FIELD FOR PULSED RAMAN TRANSITIONS
B. W. Shore, R. Sacks, and T. Karr 15 May 1987 25 p
(Contract W-7405-eng-48)
(DE87-013118; UCID-21076) Avail: NTIS HC A03

This memo discusses the induced polarization field that occurs in the presence of Raman processes and the propagation equations that result from this field. First the paper summarizes the relationship between the macroscopic polarization field and the microscopic dipole-moment expectation value. It summarizes expressions for the induced dipole moment that result from the adiabatic elimination of non-resonant molecular transitions, to produce an effective two-photon (Raman) Hamiltonian. Then it shows that the polarization field has a similar mode expansion to

the electric field. Using this result the equations for pulse propagation of the electric field are described. These equations involve a generalized gain matrix and mode velocity, as well as a refractive index, each of which depends upon position and time. Finally the paper summarizes these results and exhibits succinctly the pulse propagation equations in the plane-wave slowly-varying envelope approximation. The equations presented here must be supplemented with excitation equations (or by steady-state results) for the molecules. DOE

N88-10228# Politecnico di Milano (Italy). Dipt. di Elettronica.
EFFECTS ON ELECTROMAGNETIC WAVE PROPAGATION AT FREQUENCIES OVER 10 GHz DUE TO INHOMOGENEITIES OF THE COMPLEX REFRACTION INDEX [EFFETTI SULLA PROPAGAZIONE DI ONDE ELETTROMAGNETICHE A FREQUENZA SUPERIORE A 10 GHz CAUSATI DA DISOMOGENEITA TRAVERSALI DELL'INDICE DI RIFRAZIONE COMPLESSO]
C. Capsoni and A. Paraboni Oct. 1986 38 p In ITALIAN
Sponsored by CNR
(Rept-86-025; ETN-87-90765) Avail: NTIS HC A03/MF A01

Microwave propagation in heterogeneous media composed of suspended water or ice particles is analyzed. Anomalies detected during the SIRIO satellite experiment and confirmed by ground transmission are investigated. A large phase distortion induced by meteorological parameters is demonstrated. The analytical model of the signal received by an antenna with Gaussian directivity function is presented. The case of attitude error plus a medium with transversal heterogeneity is examined. The conclusions indicate that the observed anomalies can be explained by the joint effects of a rain cell interference and a large air refraction index variability in the air mass around the rain cell. ESA

N88-10229# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
MONITORING OF HARMFUL INTERFERENCE TO THE HF (HIGH FREQUENCY) BROADCASTING SERVICE. 3: RESULTS OF THE JUNE 1986 COORDINATED MONITORING PERIOD
M. W. Sowers, G. R. Hand, and C. M. Rush Mar. 1987 186 p
Sponsored by Voice of America, Washington, D.C.
(PB87-210274; NTIA-87-213) Avail: NTIS HC A09/MF A01
CSCL 17B

This is the third in a series of reports describing the results of studies to determine the location of sources of harmful interference to the HF broadcasting service. Using observations recorded during the June 1986 monitoring program conducted under the auspices of the International Frequency Registration Board, and observations from monitoring stations coordinated by the Institute for Telecommunication Sciences, frequently observed emitters of harmful interference and their locations were identified, the extent of such interference with programs of leading international broadcast organizations, and examines the extent of such interference on programs not specifically targeted for harmful interference. GRA

N88-10230# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
HF (HIGH FREQUENCY) BROADCASTING PLANNING MODEL: A COMPARISON OF TWO VERSIONS
J. S. Washburn, L. A. Berry, and C. M. Rush Jun. 1987 52 p
(PB87-210282; NTIA-87-217) Avail: NTIS HC A04/MF A01
CSCL 17B

The First Session of the World Administrative Radio Conference for the planning of the HF bands allocated to the broadcasting service held in Geneva, Switzerland, in January and February of 1984, established the technical criteria to be used in testing planning principles for the HF Broadcast services during the period between the First and Second Sessions of the Conference. The International Frequency Registration Board (IFRB) implemented these planning principles on a computer and reported the results at the Second Session of the World Administration Radio Conference. The Institute for Telecommunication Science (ITS) adopted a parallel activity to assist the United States' preparations for the Second Session of the Conference. The IFRB computer system and the ITS computer model and their results for the December 1985 HF broadcast plan were discussed. The results are further analyzed in terms of usage factor, tendencies in the planning process, and alternatives to the IFRB planning process. GRA

N88-10231 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
DETECTION OF TARGETS IN THE PRESENCE OF CLUTTER USING TARGET ECHO MODULATIONS CAUSED BY ROTATING STRUCTURES Thesis - Hochschule der Bundeswehr, Neubiberg, West Germany
G. Retzer Nov. 1986 142 p In GERMAN; ENGLISH summary
(Contract BMvG-T/RF31/71455/71340)
(Rept-12-86; Lfd-256; ETN-87-90393) Copyright Avail: Issuing Activity

The radar detection of hovering helicopters in the presence of clutter was investigated. It is shown that radar backscatter modulation by helicopter rotors can be described as line spectra in the frequency domain, with the spacings equivalent to the product of the rotor rotation frequency and the number of rotor blades. Typical values are between 10 and 40 Hz. Experimental results obtained with a coherent E-band pulse Doppler radar are in good agreement with calculated values. Based on these results, a detector which allows the detection of hovering helicopters in the presence of clutter is proposed. The required radar parameters, such as radar dwell time and radar pulse repetition frequency, are discussed. ESA

N88-10232# Technische Univ., Berlin (West Germany). Fachbereich Verfahrenstechnik.
ESTIMATION FILTERS WITH ADAPTIVE SCANNING TIME FOR FLYING TARGET TRACKING Ph.D. Thesis [SCHAETZFILTER MIT ADAPTIVER ABTASTZEIT FUER DIE FLUGZIELVERFOLGUNG]
Helmut Bleichrodt 1986 202 p In GERMAN
(ETN-87-90401) Avail: NTIS HC A10/MF A01

A multistage, combined test and estimation filter that maintains the expectation domain of a flying object at a given value by adapting the scanning time, was designed. It is shown how the accuracy of a Kalman filter is affected by maneuver parameters and scanning time. This allows the prediction of the efficiency of a procedure with adaptive scanning time. The effect of a filter mismatch on the estimation accuracy of the filter, and the recognition of such a mismatch using the residue process are discussed. Considering the variation width of the maneuvering parameters, the proposed six-stage adaptive filter proves to be a favorable compromise between detection sensitivity and efficient measuring data reduction. The efficiency of the adaptive procedure was demonstrated by simulations, and the effect of test parameters, fixed by the user, were determined. ESA

N88-10233# Technische Univ., Munich (West Germany). Fakultaet fuer Elektrotechnik.
SHAPE OPTIMIZATION OF LINEAR ANTENNAS Ph.D. Thesis [FORMOPTIMIERUNG VON LINEARANTENNEN]
Othmar Gotthard 1986 200 p In GERMAN
(ETN-87-90413) Avail: NTIS HC A09/MF A01

A method for the optimization of antenna geometry is presented. The arrangement of the antenna conductors in space is described by a sum of known shape functions. Target functions are formulated for the mathematical realization of the required characteristics. The antenna shape optimization is reduced to the problem of the determination of those variables in the shape function with which the target function reaches its maximum value. The FORTRAN computer program AOPT for the optimization of linear antennas is enclosed. ESA

N88-10234# Stuttgart Univ. (West Germany). Inst. fuer Navigation.
RECEPTION OF PSEUDO NOISE-MODULATED SIGNALS USING DIGITAL CORRELATORS FOR SATELLITE NAVIGATION TASKS Ph.D. Thesis [EMPFANG VON PN-MODULIERTEN SIGNALEN MIT DIGITALEN KORRELATOREN FUER AUFGABEN DER SATELLITEN-NAVIGATION]
Harald Schussler 1986 131 p In GERMAN
(ETN-87-90426) Avail: NTIS HC A07/MF A01

A digital correlation receiver for pseudo noise (PN) modulated signals is presented. The principles of operation and the characteristics of the receiver are explained. The concept is based on a signal structure, used in the spread spectrum technique, satellite navigation, and telemetry and ranging systems. A theoretical, comprehensive signal analysis revealed the characteristics and particularities of the proposed concept. The effects of different perturbations, such as Doppler shifts, oscillator instabilities, analog-to-digital conversion, channel noise, and selective noise sources are treated. A simulation program is enclosed. ESA

N88-10235# Stuttgart Univ. (West Germany). Inst. fuer Nachrichtenuebertragung.
DIGITAL RECEIVER STRUCTURES AND METHODS FOR THE DETERMINATION OF THE SCANNING FREQUENCY IN MODEMS FOR FAST DATA TRANSMISSION VIA TELEPHONE CHANNELS Ph.D Thesis [DIGITALE EMPFAENGERSTRUKTUREN UND VERFAHREN ZUR TAKTABLEITUNG IN MODEMS ZUR SCHNELLEN DATENUEBERTRAGUNG UEBER FERNSPRECHKANAELE]
Gert Eilenberg 1986 240 p In GERMAN Sponsored by Deutschen Forschungsgemeinschaft, West Germany
(ETN-87-90429) Avail: NTIS HC A11/MF A01

Digital structures of modem components and control systems and their behavior were investigated using digital simulation. An optimal maximum likelihood receiver structure is described. Mathematical methods and models for a nearly realistic simulation of digital modem systems are treated, with emphasis on the control systems for amplitude, distortion correction, carrier recovery, and scanning frequency determination. The global data transmission channel was simulated; the required special arrangements for the control systems, their structure and dimensioning are described. Experimental results demonstrate the efficiency of the digital simulation, but also that the perturbing effects of a digital realization have to be minimized. ESA

N88-10236# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung HF-Physik.
AN INVESTIGATION ON FARADAY ROTATORS AND QUARTER-WAVE PLATES OF A 35 GHz RADAR SIGNATURE SYSTEM
Reinhard Hammel Mar. 1987 77 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-14; ISSN-0171-1342; ETN-87-90598) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 26

It is shown which polarization ellipses can be generated by a quarter-wave plate by taking into account the effects of phase deviations of the quarter-wave plates from pi/4. The mode of operation of quarter-wave plates and Faraday rotators in transmitting and receiving antennas is presented, especially as to setting errors. It is shown how the slope of the major axis of a polarization ellipse can be measured by the use of two independent orthogonally polarized receiving antennas if the polarizations of the receiving antennas are determined by quarter-wave plates and Faraday rotators. The misadjustment of the Faraday rotators caused by hysteresis effects is demonstrated with respect to linear polarization; it is shown how to avoid these errors. ESA

N88-10237# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
THE WAVENUMBER: AN ALTERNATIVE TO THE DIRECTIONAL COUPLER FOR MULTIMODE ANALYSIS IN OVERSIZED WAVEGUIDES
W. Kasparek and G. A. Mueller Mar. 1987 31 p Submitted for publication
(IPF-87-2; ETN-87-91017) Avail: NTIS HC A03/MF A01

The problem of measuring a broad spectrum of discrete modes in oversized waveguides is discussed. Analysis of the standard solution, the directional coupler, shows that the measured signals can be ambiguous in mode selectivity and directivity. Therefore an instrument, the wavenumber spectrometer, which avoids the problem of ambiguity was developed. The instrument has extremly high directivity and allows the measurement of all TE and TM modes with the same instrument. The device inherently has a large frequency bandwidth. This wavenumber spectrometer consists of a leaky-wave antenna structure in the wall of the waveguide and of a movable receiver antenna with high directivity. From the radiation pattern of the leaky-wave antenna, as measured by the receiver antenna, the spectrum of the modes propagating in the waveguide is deduced. ESA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N88-10238# Oxford Univ. (England). Inorganic Chemistry Lab.
NEW MATERIALS FOR ELECTROCHEMICAL CELLS Final Report, 1 Jan. 1983 - 31 Dec. 1986
John B. Goodenough and P. G. Dickens 20 Jun. 1987 9 p
(Grant AF-AFOSR-0052-83)
(AD-A183659; AFOSR-87-0936TR) Avail: NTIS HC A02/MF A01 CSCL 10C

The research had two main aims: (1) determination of the thermochemical, structural and electrochemical properties of insertion compounds and materials showing mixed electronic/ionic conduction, and (2) the design, preparation and characterization of new materials for use as electrolytes or cathode materials in solid state cells. The progress of this research has been described in the series of scientific reports and renewal proposals submitted during the research period and discussed in detail through the scientific publications listed above. New ambient-temperature lithium and hydrogen insertion compounds have been prepared from the uranium oxides U3O8, alpha, gamma and delta UO3. Electrochemical and thermochemical parameters have been determined for these phases and also for the hydrogen insertion compounds of vanadium oxide mixed molybdenumtungsten trioxides and new structural modifications tungsten oxide and molybdenum oxide; the phase previously known as hexagonal MoO3 has been shown to be a partially deammoniated and dehydrated ammonium decamolybdate. GRA

N88-10239# Minnesota Univ., Minneapolis. Corrosion Research Center.
IONICALLY CONDUCTIVE POLYMERS: APPLICATION TO SOLID STATE BATTERIES Technical Report, Sep. 1986 - Aug. 1987
Boone B. Owens, M. Z. Munshi, and Paul M. Skarstad (Medtronic, Inc., Minneapolis, Minn.) Jul. 1987 6 p Presented at the 38th Meeting of the International Society for Electrochemistry, Maastricht, Netherlands, Sep. 1987
(Contract N00014-85-K-0634)
(AD-A183733; TR-9) Avail: NTIS HC A02/MF A01 CSCL 10C

The use of polymeric ionically conducting electrolyte materials in the fabrication of solid state batteries was proposed

approximately ten years ago. Subsequently, a large number of groups have investigated a variety of polymer electrolytes, such as the polyethylene oxide complexes of various lithium salts. Independent efforts were concurrently expended on polymer electrodes, such as polyacetylene, for batteries. The feasibility of batteries of either type has been tested in a variety of research cells, and in some prototype hardware of practical size. Nonetheless, there are at present no commercially available polymer batteries of either type. A stable battery design with the abiiity to store and to deliver energy efficiently and economically is the prime objective of the development programs in polymeric batteries. GRA

N88-10240# Institute of Microwave Technology, Stockholm (Sweden).
PHASE 2 DEVELOPMENT OF A 12 GHz MMIC FET AMPLIFIER Final Report
Boris Kerzar, Florian Sellberg, and Ryszard Vogel Paris, France ESA 10 Nov. 1986 69 p
(Contract ESTEC-5679/83-NL-GM)
(IM-I86-1010; ESA-CR(P)-2395; ETN-87-90529) Avail: NTIS HC A04/MF A01

Design, processing, and evaluation of an implanted, 0.75 micron gate length FET for a 12 GHz MMIC amplifier are described. An available gain of at least 8 dB at 14.5 GHz is reached with several different implantation dose specifications for a design capable of delivering an output power of 100 mW. An MMIC amplifier stage design was characterized and compared to computer modeling with good agreement. The yield of good FETs is too low though to result in amplifier samples with the optimum achievable gain. ESA

N88-10241# Sandia National Labs., Albuquerque, N. Mex.
OPERATION OF THE TEMPO MACHINE
G. J. Rohwein, R. N. Lawson, and K. T. Lancaster 1987 4 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011285; SAND-87-0019C; CONF-870656-18) Avail: NTIS HC A02/MF A01

The TEMPO machine is a repetitively pulsed, high-voltage driver for experimental microwave generating devices. Three units have been built. TEMPO has a transformer-charged, water-insulated Blumlein directly coupled to the vacuum diode. The Blumlein has a relatively high impedance (20-ohm) strip-type, pulse-forming transmission line (PFL) designed to minimize size. Stray capacitance and enhanced electric fields along the edges of the PFL are controlled by lining the tank in which the Blumlein is housed with polyvinyl chloride (PVC) plastic sheet. During the initial stage of operation, problems with breakdowns in the plastic occurred that necessitated replacing the liner with either polyethylene or polypropylene. During the same period, problems with the power supplies and high voltage switch performance were addressed. These modifications and their results are discussed in the following sections. DOE

N88-10242# Sandia National Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A REPETITIVE 1-MV, 22-kJ MARX GENERATOR
M. W. OMalley and M. T. Buttram 1987 4 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011286; SAND-87-0279C; CONF-870656-9) Avail: NTIS HC A02/MF A01

A 220-kW Marx generator has been designed, built, and tested. It was developed to drive several different pulse power experimental devices requiring repetitive pulses at voltages to 1 MV and energies to 22 kJ per pulse. Experiments are planned that will explore dielectric performance under repetitive stress, cold cathode diode operation, and repetitive switching with saturable inductors at moderate peak power and voltage. A Marx generator was chosen because it has the versatility to drive such a variety of loads. The Marx generator system is made of 16 inductively isolated capacitor stages resistively charged to a maximum of 62.5 kV per capacitor and eight gas dynamic spark gaps. The charging source is a 2-MW dc bipolar power supply. The gas purging system is capable of supplying 3500 SCFH of air at the required pressure. The first two spark gaps of the Marx generator are triggered with a grounded grid thyratron pulser through a 1:10 step-up transformer with an output peaking gap as an (unused) option. At the maximum output (1 MV, 22 kJ) a repetition rate of 10 Hz is possible. This paper will review some of the development work done on rep rated Marx generators as well as explain the present Marx generator configuration and associated hardware systems. DOE

N88-10243# Lawrence Livermore National Lab., Calif.
DESIGN AND ANALYSIS OF A BROADBAND TM(SUB 01) MODE GENERATOR IN CYLINDRICAL WAVEGUIDE
Scott C. Burkhart 1986 8 p Presented at the 2nd International Microwave Symposium, Rio de Janeiro, Brazil, 27 Jul. 1986
(Contract W-7405-eng-48)
(DE87-011308; UCRL-95843; CONF-8607330-1) Avail: NTIS HC A02/MF A01

A generator for launching the TM sub 01 mode in a cylindrical waveguide is described. Two-dimensional modeling demonstrated a mode purity (TM sub 02/TM sub 01 mode) in excess of 20 dB across most of the design 6 to 10 GHz. Testing of two fabricated generators showed that good mode purity was obtained in practice. DOE

N88-10244# Los Alamos National Lab., N. Mex.
OPTIMUM SIZE OF STAGED FLUX COMPRESSION GENERATORS
J. E. Vorthman 1987 4 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract W-7405-eng-36)
(DE87-011741; LA-UR-87-2138; CONF-870656-22) Avail: NTIS HC A02

This paper presents the results of an investigation to determine when two small transformer coupled flux compression generators are better than one large generator. The system considered consists of a helical flux compression generator transformer coupled to an inductive load. The question is then whether the system energy gain (final load energy divided by initial system energy) would be greater if the generator were split in half and a transformer used to connect the pieces. For the lossless case, this problem has been solved exactly in terms of the transformer k factor and the initial and final generator inductances. An approximate solution which assumes a simple loss model is also discussed. DOE

N88-10245# Lawrence Livermore National Lab., Calif.
AN OPTICALLY STROBED SAMPLE AND HOLD CIRCUIT
C. McConaghy Jan. 1987 6 p Presented at the IEEE/OSA Topical Meeting on Picosecond Electronics and Optoelectronics, Lake Tahoe, Nev., 14 Jan. 1987
(Contract W-7405-eng-48)
(DE87-011877; UCRL-95287; CONF-870114-4) Avail: NTIS HC A02/MF A01

Radiation damaged photoconductors have been shown to be useful devices for sampling repetitive electrical signals with time resolution to less than a picosecond. In previous work, the signal being sampled has generally had to repeat in order to be averaged by a lock-in amplifier for detection. In contrast, the circuit described in this paper is designed to make one sample on a non-repetitive signal with a 10 picoseconds aperture and then hold this sample for a microsecond. The hold time only needs to be long enough for the signal to be A to D converted. This circuit was designed as a prototype with the intent of integrating a number of these circuits in the future for making multiple samples, offset in time, on a single electrical transient signal and thereby capture the transient. This paper will be concerned with the design, fabrication and testing of one of these optically strobed sample and hold circuits. DOE

N88-10246# Oak Ridge National Lab., Tenn.
DESIGN AND TESTING OF ELECTRICAL INSULATION FOR SUPERCONDUCTING COILS
S. W. Schwenterly 1987 11 p Presented at the Conference on Advances in Cryogenic Engineering, St. Charles, Ill., 14 Jun. 1987
(Contract DE-AC05-84OR-21400)
(DE87-012256; CONF-8706125-9) Avail: NTIS HC A03/MF A01

This paper reviews and summarizes the dielectric properties of liquid and gaseous helium and nitrogen, vacuum, and solid insulation materials for practical insulation design for superconducting coils. The influence of electrode geometry on breakdown voltage is discussed, and features that require special care are pointed out. Appropriate room-temperature high-voltage testing is considered. Finally, the paper examines the implications for coil insulation design of a new class of superconductors that can operate at temperatures approaching 77 K. DOE

N88-10247# Allied Bendix Aerospace, Kansas City, Mo.
WIRE INTERCONNECTION RELIABILITY AND MOISTURE LEVELS IN HYBRID MICROCIRCUITS WITH EPOXY-ATTACHED COMPONENTS
R. J. Blazek Jul. 1987 19 p Presented at the International Society for Hybrid Microcircuits Conference, Minneapolis, Minn., 28 Sep. 1987
(Contract DE-AC04-76DP-00613)
(DE87-012987; BDX-613-3721; CONF-8709114-1) Avail: NTIS HC A03/MF A01

A hybrid microcircuit chip and wire technology was evaluated that consists of chip components attached by epoxy to either thin film or multilayer thick film networks and interconnected with gold wires. This technology was reviewed to qualify it for Department of Energy products, which must withstand long-term storage and extreme environmental requirements. The study included destructive wire pull testing, ball bond shear testing, internal moisture and material analysis, environmental testing, and accelerated aging. Wire pull strengths that averaged 8.92 g and ball bond shear strengths that averaged 44 g were similar, regardless of the HMC assembly, environmental, or aging conditions. Minimum wire pull strengths that met Mil-Std-883C requirements comprised 99.55% of the total wires, and average internal moisture levels met Mil-Std-883C requirements. Wire pull strengths did not decrease, and bond delaminations and intermetallics did not increase after accelerated aging for 1000 hours at 150°C. An existing chip and wire technology will be upgraded by replacing the present component epoxy with one that generates lower moisture levels and contamination. Plasma cleaning components and networks before wire bonding also will improve wire reliability. Thermosonic wire bond schedules will be optimized for specific chip components, and intermetallic and epoxy contamination problems will be monitored with ball bond shear testing. DOE

N88-10248# Oak Ridge National Lab., Tenn.
METHODOLOGY FOR CONTROL AND OPERATION OF WIND ARRAYS IN UTILITY SYSTEMS Final Report
Jul. 1987 11 p
(Contract DE-AC05-84OR-21400)
(DE87-013129; ORNL/M-379) Avail: NTIS HC A03/MF A01

A series of report briefs are presented in the field of electric power systems. These briefs are composed of short research summaries dealing with the control and operation of wind arrays in utility systems; fault current limiters for generator bus protection; solid dielectric and synthetic laminar cable insulations; the impact of the steep-front, short duration impulse on electric power system insulation; and the impact of high altitude electromagnetic pulse on electric power systems. DOE

N88-10249# General Electric Co., Largo, Fla. Neutron Devices Dept.
GASES RELEASED BY SURFACE FLASHOVER OF INSULATORS
H. C. Miller and R. J. Ney 20 Jul. 1987 22 p
(Contract DE-AC04-76DP-00656)
(DE87-013851; GEPP-TIS-1016) Avail: NTIS HC A03/MF A01

The gases released by surface flashovers on alumina ceramics, Pyrex glass, and quartz, using 20 microsecond voltage pulses were investigated using an ion pumped metal vacuum system. Appreciable quantities of gas were measured (approximately 0.000006 torr-liters or 10 to the 13th molecules). The composition of this gas differed significantly from the background gas. The dominant species in the surface flashover gases were CO2, CO, and H2; a modest amount of CH4 was observed, along with lesser quantities of N2 and H2O. The dominant gas in the system background was nitrogen, accompanied by (in decreasing amounts) H2, H2O, CO/CO2, Ar, CH4, and He. We concluded that the gas released by flashovers on the surface of the insulators was not absorbed system background gas, but gas was adsorbed during the handling and processing of the insulator. DOE

N88-10250# General Electric Co., Largo, Fla. Neutron Devices Dept.
RECOVERY OF VACUUM GAPS AFTER ARCING
H. C. Miller 11 Jun. 1987 32 p
(Contract DE-AC04-76DP-00656)
(DE87-013852; GEPP-TIS-963A) Avail: NTIS HC A03/MF A01

This paper reviews the recovery of vacuum gaps: i.e., the return of the voltage holdoff capability of a vacuum gap after it has ceased to sustain a vacuum arc. After a brief description of vacuum arcs, the paper discusses cathode and anode arc phenomena as they affect recovery. Finally, various experimental results pertinent to recovery are presented and discussed. During conduction a vacuum gap contains electrons, ions, neutral atoms (vapor), and macroparticles of electrode material. At current zero the production of electrons, ions, and macroparticles ceases immediately. If an anode spot is present it will take tens of microseconds to milliseconds for significant production of neutral vapor to cease; the time depending upon the rate at which the anode spot cools, which in turn depends upon the anode material and upon the size and depth of the anode spot at current zero. Early recovery is controlled by ions, later recovery by neutral atoms. The ultimate recovery voltage is a function of electrode surface properties. Magnetic fields may be used to promote recovery by helping to clear the vacuum gap of ions and electrons and by preventing the formation of anode spots or moving them before current zero. The most important requirement in obtaining the fastest recovery times is to design the vacuum gap to avoid the formation of anode spots, thus insuring that only cathode recovery phenomena are significant. DOE

N88-10251 Arizona Univ., Tucson.
PHYSICS AND DEVICE DESIGN OF VACUUM INTEGRATED CIRCUITS Ph.D. Thesis
Lazaro Manuel Hong 1987 349 p
Avail: Univ. Microfilms Order No. DA8712881

A general schematic method is developed by modeling the fundamental parameters of vacuum integrated circuits (VIC), a class of microelectronics devices. A summary of the history of thermionic integrated circuits (TIC) is presented, along with a discussion of the heater and its effect on device performance. The effects of the base metal on the emission properties of cathodes which are a mixture of the emission carbonates and negative photoresist are also considered. The amplification factor is determined by using either a first or second order model depending on the desired degree of accuracy. The transconductance and anode resistance may be calculated as well by using the perveance model of cathode current. Electrostatic interactions between devices are important in the design of vacuum integrated circuits. The percent interaction function is used to quantify the effects of dc and small signal electrostatic interactions. The effect of work function differences on the dc biasing of circuits is also considered. The pseudo-radial electrostatic (PREF) lens is used to the electrons in a quasi-circular orbit from cathode to anode. The theory and experimentally determined characteristics of these devices are presented in detail. Dissert. Abstr.

N88-10252# Oak Ridge National Lab., Tenn.
NEW CONCEPTS FOR HIGH CURRENT SELF-SUSTAINED DIFFUSE DISCHARGE CLOSING SWITCHES
S. R. Hunter, L. G. Christophorou, J. G. Carter, and P. G. Datskos 1987 9 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE87-011678; CONF-870656-32) Avail: NTIS HC A02

Developed are new switching concepts that potentially can increase the efficiency and stability of high current diffuse discharges when used in repetitive fast closing switch applications. The primary advantage of diffuse discharges over spark gap closing switches is that a diffuse discharge has a much faster recovery time (less than 10 to the -4 s) compared to an arc discharge (more than 10 to the -3 s), enabling the switch to be operated at high repetition rates. The major disadvantage of diffuse discharges are the high sustaining voltage across the discharge and the resultant high switch impedance (several ohms) compared with spark gaps (much less than 1 ohm). Also explored is a new diffuse glow discharge operating scheme with a new type of gas mixture whose components collectively possess an ionization coefficient, alpha/N, at low E/N which is larger than the attachment coefficient, eta/N, over a given, E/N range, while at higher E/N values, eta/N is larger than alpha/N over another range of E/N values. DOE

N88-10253# Sandia National Labs., Albuquerque, N. Mex.
A HIGH-VOLTAGE MULTISTAGE LASER-TRIGGERED GAS SWITCH
G. J. Denison, J. P. Corley, D. L. Johnson, G. J. Weber, R. A. Hamil, G. W. Crowder, J. A. Alexander, D. A. Petmecky, L. P. Schanwald, and J. J. Ramirez 1987 5 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011725; SAND-87-0107C; CONF-870656-15) Avail: NTIS HC A02/MF A01

This paper describes the development and testing of an SF-insulated, multistage laser-triggered gas switch for use in the Hermes-III accelerator at Sandia National Laboratories. Twenty of these switches are used in Hermes III to transfer energy from intermediate energy storage water-dielectric capacitors to the pulse-forming lines (PFLs) and to provide the overall synchronization of the accelerator. The gas switches operate in an oil environment, are charged to a peak voltage between 2.2 and 2.4 MV in approx. 1 microsec and are laser triggered with a root-mean-square (RMS) jitter equal to or less than 2 ns. Both the triggered and untriggered performance of the switch have been investigated. A summary of the development tests is presented together with initial results from Hermes III. DOE

N88-10254# Sandia National Labs., Albuquerque, N. Mex.
INVESTIGATIONS INTO THE DESIGN OF MULTI-TERAWATT MAGNETIC SWITCHES
H. C. Harjes, K. J. Penn, G. A. Mann, and E. L. Neau 1987 5 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012014; SAND-87-0172C; CONF-870656-40) Avail: NTIS HC A02

Magnetic switches were successfully used for pulse compression in the CometII pulsed power module to deliver 2.7 MV and 3.7 TW to a 2 matched load. However, the Comet switches suffered interwinding dielectric breakdowns and failed in less than 100 shots. Initial results from experiments on magnetic switch core insulations indicate that the insulation scheme used in the Comet switches was not optimal and better configurations exist. The Comet magnetic switch failures have been duplicated and studied on the Magnetic Switch Test Module (MSTM), a coaxial, 2 PFL driven by a 600 kV Marx generator. The results of these experiments are discussed in detail. DOE

N88-10255# Sandia National Labs., Albuquerque, N. Mex.
SIMULATIONS USING THE PSEUDO-CURRENT ALGORITHM
B. M. Marder 1987 5 p Presented at the 12th Conference on the Numerical Simulation of Plasmas, San Francisco, Calif., 20 Sep. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012403; SAND-87-1745C; CONF-870947-3) Avail: NTIS HC A02/MF A01

The pseudo-current algorithm in electromagnetic particle-in-cell codes is a method for keeping the error in Gauss' Law bounded by some predetermined tolerance. It places no restrictions on how charge and current density are computed. In particular, simple area weighting can be used. Nor does the technique require solving elliptic equations. What it does is diffuse away errors generated by local numerical inaccuracies in a manner consistent with Maxwell's equations. This technique, as described in this report, has been used in numerical simulations of microwave generating devices such as magnetrons, backward wave oscillators, and a new device developed in large part through the simulations, the magnetically insulated transmission line oscillator, or MILO. DOE

N88-10256# Lockheed Missiles and Space Co., Palo Alto, Calif.
ZINC-REDOX BATTERY: A TECHNOLOGY UPDATE
R. P. Hollandsworth 1987 18 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE87-010737; SAND-87-7127C; CONF-871027-20) Avail: NTIS HC A03/MF A01

Since 1977, scientists at Lockheed Missiles and Space Company, Inc., have been developing the Zinc-Redox Battery for large-scale electrical energy storage. The current state of technology for this battery has demonstrated a number of positive features: (1) high energy efficiency (82.6 +/- 4.4%) demonstrated for more than 754 cycles with a low-cost alpha-methyl styrene membrane; (2) minimal environmental concerns because the only toxic reactant is 2N sodium hydroxide, and thus low projected balance-of-plant costs; and (3) good cell performance over a wide range of discharge rates with cell IR being the main determinant of energy efficiency. Current studies have focused on zinc electrode performance parameters, high current density discharge evaluation, and low-cost membrane cycle-life performance. DOE

N88-10257# Sandia National Labs., Albuquerque, N. Mex.
EVALUATION OF STAND-ALONE INVERTERS FOR REMOTE APPLICATIONS
W. Bower 1987 19 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE87-010957; SAND-87-1189C; CONF-871027-21) Avail: NTIS HC A03/MF A01

A stand-alone or autonomous system that supplies ac electric power to loads in remote applications is a mini-utility. It requires all the basic elements of a large system. These basic elements are an energy source, a storage medium, and a power conditioner (inverter) with built-in or external control and distribution capabilities. The source for an autonomous system will probably be one of the renewable sources of energy such as wind or photovoltaics. The electrical storage will be a battery bank. The inverter, with the variable energy source and the energy storage sized for the autonomy of the system, must be capable of converting the energy and supplying controlled ac power to the loads on demand and in a safe, efficient, reliable, and compatible manner. This paper describes the evaluation of several small (typically 1-kW) stand-alone power conditioners. The purpose of these evaluations was to determine the dc input and ac output characteristics of the power conditioners, the control algorithms, and the compatibility and interactions of the power conditioners with the complex loads most likely to be used with the stand-alone or autonomous systems. DOE

N88-10258# Argonne National Lab., Ill.
EVALUATION OF LiCl- LiBr- KBr ELECTROLYTE FOR LI-ALLOY/METAL DISULFIDE CELLS
T. D. Kaun 1987 11 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract W-31-109-eng-38)
(DE87-011356; CONF-871027-25) Avail: NTIS HC A03/MF A01

The physical properties of a new molten salt electrolyte for lithium-alloy/metal disulfide cells, 25 mol % LiCl-37 mol % LiBr-38 mol % KBr, were investigated. Cyclic voltammetry of FeS in the new molten salt at 375 to 425°C indicated improved electrochemistry and stability of the reaction on the upper voltage plateau (1.75 V vs. LiAl). The new electrolyte provides an opportunity to operate an upper-plateau (UP) FeS electrode at a lower temperature, 400°C, and with a higher activity of lithium ion in the electrolyte. The broad liquidus of this molten salt at 400°C also supports operation at high current density. Testing of 24- to 48-Ah cells indicated greater than 50% improved energy and power density over the conventional two-plateau FeS cell with LiCl-KCl electrolyte. The conventional FeS cells would lose 50% of their upper-plateau capacity within 200 cycles. The elimination of this capacity decline problem was demonstrated by 400 cycles and 5400 h of stable operation with a dense UP FeS electrode cell, which maintained 89% utilization of theoretical capacity throughout the test. DOE

N88-10259# Argonne National Lab., Ill.
HYDRIDE GENERATION FROM THE EXIDE LOAD-LEVELING CELLS
J. J. Marr and J. A. Smaga May 1987 11 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract W-31-109-eng-38)
(DE87-011361; CONF-871027-23) Avail: NTIS HC A03/MF A01

Stibine and arsine evolution from lead-acid cells in a 36-kWh Exide load-leveling module was measured as this module approached 1900 cycles of operation. A gas-collection apparatus enabled us to determine the maximum and average rates for evolution of both toxic hydrides. Hydride generation began once the cell voltage exceeded 2.4 V. The maximum rate for arsine occurred just above 2.5 V and consistently preceded the peak rate for stibine for each sampled cell. The average rates of hydride generation were found to be 175 g/min for stibine and 12.6 g/min for arsine. The former rate proved to be the critical value in determining safe ventilation requirements for cell off-gases. The minimum airflow requirement was calculated to be 340 L/min per cell. Projections for a hypothetical 1-MWh Exide battery without an abatement system indicated that the normal ventilation capacity in the Battery Energy Storage Test facility provides nearly five times the airflow needed for safe hydride removal. DOE

N88-10260# Argonne National Lab., Ill.
OVERCHARGE PROTECTION IN LI-ALLOY/METAL DISULFIDE CELLS
L. Redey 1987 9 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract W-31-109-eng-38)
(DE87-011364; CONF-871027-26) Avail: NTIS HC A02/MF A01

Charge and overcharge reactions of FeS, NiS, and (Fe-Ni)S electrodes were studied in half-cell and full-cell experiments to investigate the electrochemical stability of these materials at high charge potentials. In LiS-saturated (LiCl-KCl, LiF-LiCl-LiBr, and LiCl-LiBr-KBr) electrolytes, a new plateau appeared at 2.05-2.1 V vs Li-Al and was associated with polysulfide anion formation. The polysulfide seems to stabilize the transition-metal sulfides against overcharge-related dissolution, even at 2.2 V. The anodically formed polysulfide provides overcharge tolerance for Li-alloy/MS cells by an electrochemical-chemical sulfide/polysulfide cycle. DOE

N88-10261# Los Alamos National Lab., N. Mex.
CHARACTERIZATION OF SURFACE DISCHARGE SWITCHES AND HIGH PERFORMANCE APPLICATIONS
R. E. Reinovsky, J. H. Goforth, A. E. Greene, and J. Graham 1987 9 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987 Prepared in cooperation with Maxwell Labs., Inc., San Diego, Calif.
(Contract W-7405-eng-36)
(DE87-011763; LA-UR-87-2094; CONF-870656-25) Avail: NTIS HC A02

Results of experiments which were conducted to characterize the performance of a surface discharge as a high-performance, self-closing isolation switch for high energy applications are described. These experiments, conducted under both dc and pulsed conditions, lead to a model of switch operation which enables the design of such switches for multi-megajoule operation. The paper describes the successful implementation of a surface switch as an operational component in a multi-megampere pulse-power system. DOE

N88-10262# Sandia National Labs., Albuquerque, N. Mex.
TOWARD PULSED POWER USES FOR PHOTOCONDUCTIVE SEMICONDUCTOR SWITCHES: CLOSING SWITCHES
G. M. Loubriel, M. W. OMalley, and F. J. Zutavern 1987 4 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012020; SAND-87-0017C; CONF-870656-38) Avail: NTIS HC A02

Recent results of tests on Photoconductive Semiconductor Switches (PCSS) are presented. For Si and GaAs switches, surface flashover, contact degradation, and current limitations are addressed. For Si, samples have been obtained that, without being triggered, withstand fields of up to 85 kV/cm produced by an approx. 2-micron wide voltage pulse. The 1-inch diameter, Si samples (gap length of 1.5 cm) have been switched at 36 kV/cm (approx. = 54 kV) into an approx. 30-ohm load with a current of 703 A. For GaAs, most samples can withstand, without being triggered, 100 kV/cm. At low electric fields the GaAs samples behave as switches that close during the laser pulse and then open in nanoseconds. At high voltages GaAs does not open. In this mode, called lock-on, up to 42.7 kV/cm (64.1 kV) has been switched. The lock-on mode can be triggered with small laser powers. Plans are being made to use large arrays of GaAs samples to switch 1 MV and 156 kA. DOE

N88-10263# Sandia National Labs., Albuquerque, N. Mex.
RECENT DEVELOPMENTS IN OPENING PHOTOCONDUCTIVE SEMICONDUCTOR SWITCHES
F. J. Zutavern, G. M. Loubriel, and M. W. OMalley 1987 9 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012130; SAND-87-1367C; CONF-870656-35) Avail: NTIS HC A02

While developing high power photoconductive semiconductor switches (PCSS), extremely fast opening times and what appears to be the onset of non-destructive electron avalanching have been recorded. Using 1- and 2-in diam. wafers of GaAs, Cr:GaAs, and Au:Si, we have switched a 50-ohm, 80-ns transmission line at voltages up to 65 kV. In the dark, the GaAs switches will stand off dc fields up to 30 kV/cm in SF6. On optical triggering, the behavior depends on the average electric field. Below 4 kV/cm (8 kV/cm doped) they open with a 20-ns (less than 3 ns doped) exponential recovery time. When the light is removed above these fields, the switches lock on, conducting whatever current the circuit will supply and stabilizing to 4 kV/cm (8 kV/cm doped) across the switch. Additionally, reliable triggering of a 2-inch GaAs switch (3.4-cm gap) in this locking on mode was achieved with a 70 microJ, 532-nm, 10-ns light pulse (less than 1/100th the light required to trigger the switch at low voltages). The Au:Si samples did not lock on, opening with an exponential recovery time of 20

to 40 ns at fields up to 35 kV/cm. Undoped silicon samples show recovery times of several hundred microsecs. DOE

N88-10264# Sandia National Labs., Albuquerque, N. Mex.
ANALYSIS OF THE ELECTROMAGNETIC PERFORMANCE CHARACTERISTICS OF STRIPLINE TRANSFORMERS
J. D. Kotulski Jul. 1987 13 p
(Contract DE-AC04-76DP-00789)
(DE87-012515; SAND-87-0580) Avail: NTIS HC A03/MF A01

The electromagnetic parameters (self-inductances, coupling factor, and resistance) of circular stripline transformers are calculated using the canonical problem of a current loop. A 10-to-1-turn transformer is analyzed and the results are compared to measurements. A 1-to-1 transformer is also considered, and the effect of geometry on the parameters is determined. DOE

N88-10265# Gould, Inc., Rolling Meadows, Ill. Research Center.
LITHIUM/IRON SULFIDE BATTERIES: DEVELOPMENT AND DEMONSTRATION
G. Barlow and A. A. Chilenskas Aug. 1987 107 p Prepared in cooperation with Argonne National Lab., Ill. and Electric Power Research Inst., Palo Alto, Calif.
(Contract W-31-109-eng-38)
(DE87-014222; EPRI-EM-5183) Avail: NTIS HC A06/MF A01

This volume contains two reports, each dealing with progress in the development of the lithium/iron-sulfide battery. The first report, from Gould, deals directly with the construction of cells and batteries; the second report, from Argonne National Laboratories, deals with the engineering and design of a thermal enclosure and a battery charger for the secondary battery system. Results of construction and testing of two nine-cell battery models are presented along with the beneficial effects of engineering changes in the ratio of positive to negative reactants. Results of design and construction of a thermal enclosure and of cycling of the lithium/iron-sulfide battery in the enclosure under an SAE driving profile are presented. DOE

N88-10266*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF ELECTRON AND PROTON IRRADIATIONS ON n/p AND p/n GaAs CELLS GROWN BY MOCVD
Irving Weinberg, Clifford K. Swartz, and Russell E. Hart, Jr. 1987 8 p Presented at the 3rd International Photovoltaic Science and Engineering Conference, Tokyo, Japan, 3-6 Nov. 1987; sponsored by the Japan Society of Applied Physics
(NASA-TM-100199; E-3792; NAS 1.15:100199) Avail: NTIS HC A02/MF A01 CSCL 09C

State-of-the-art n/p and p/n heteroface GaAs cells, processed by metal organic chemical vapor deposition, were irradiated by 1 MeV electrons and 37 MeV protons and their performance determined as a function of fluence. It was found that the p/n cells were more radiation resistant than the n/p cells. The increased loss in the n/p cells was attributed to increases in series resistance and losses in the p-region resulting from the irradiation. The greater loss in fill factor observed for the n/p cells introduces the possibility that the presently observed superiority of the p/n cells may not be an intrinsic property of this configuration in GaAs. Author

N88-10267*# TRW Defense Systems Group, Redondo Beach, Calif.
V-BAND IMPATT POWER AMPLIFIER Final Report
S. W. Schell Sep. 1985 81 p
(Contract NAS5-27331)
(NASA-CR-180711; NAS 1.26:180711) Avail: NTIS HC A05/MF A01 CSCL 09A

This program is the result of the continuing demand and future requirement for a high data rate 60-GHz communications link. A reliable solid-state transmitter which delivers the necessary power over a wide bandwidth using the present IMPATT diode technology required the development of combining techniques. The development of a 60-GHz IMPATT power combiner amplifier is detailed. The results form a basis from which future wideband, high-power IMPATT amplifiers may be developed. As a result, several state-of-the-art advancements in millimeter-wave components technology were achieved. Specific achievements for the amplifier integration were: development of a nonresonant divider/combiner circuit; reproducible multiple junction circulator assemblies; and reliable high power 60-GHz IMPATT diodes. The various design approaches and tradeoffs which lead to the final amplifier configuration are discussed. A detailed circuit design is presented for the various amplifier components, and the conical line combiner, radial line combiner, and circulator development are discussed. The performance of the amplifier, the overall achievement of the program, the implications of the results, and an assessment of future development needs and recommendations are examined. B.G.

N88-10268# Technische Univ., Berlin (West Germany). Fachbereich Elektrotechnik.
EDDY CURRENT DENSITY IN WEDGE-SHAPED CONDUCTING CYLINDERS WITH INHOMOGENEOUS CONDUCTIVITY Ph.D. Thesis [DIE WIRBELSTROMDICHTE IN KEILFOERMIGEN LEITENDEN ZYLINDERN INHOMOGENER LEITFAEHIGKEIT]
Naser Sakaji 1987 100 p In GERMAN
(ETN-87-90404) Avail: NTIS HC A05/MF A01

An analytical method for the calculation of eddy currents induced in wedge-shaped conductors was developed. The wedge-shaped conducting cylinders are in the field of a two-wire line in which an alternating current flows. By symmetry considerations the problem was reduced to two partial problems. For each partial problem three spaces were considered. For each space assumptions for the field-describing vector potential were deduced, leading to a complex transcendental eigenvalue equation for the constants of the potential assumptions. The fulfilment of the boundary conditions leads to a linear system of equations which was numerically solved. Using the calculated constants, the induced eddy current density was computed and graphically represented for several dimensions. The magnetic field lines for small and large skin depths are shown. ESA

N88-10269# Technische Univ., Berlin (West Germany). Fachbereich Elektrotechnik.
THE METHOD OF RIGID ARMATURE FLUX ORIENTATION FOR THE FIELD-ORIENTED CONTROL OF HIGHLY DYNAMIC DRIVES WITH SYNCHRONOUS MACHINES Ph.D. Thesis [DAS VERFAHREN DER STARREN ANKERFLUSSORIENTIERUNG FUER DIE FELDORIENTIERTE REGELUNG HOCHDYNAMISCHER ANTRIEBE MIT SYNCHRONMASCHINEN]
Claus Ritter 1987 222 p In GERMAN
(ETN-87-90405) Avail: NTIS HC A10/MF A01

A control system and model for drives with conventional synchronous machines were developed. A literature study shows that the control method which orients the indicator of armature current and flux perpendicular to each other is most suited. A method of rigid armature flux orientation was designed. This method allows a fast adjustment of the torque as in converter-fed dc machines; simultaneously the operating conditions can be maintained. The control concept and the different control loops are described. The test results agree very well with theoretical predictions. With the proposed method a direct proportionality between armature current and torque is obtained. ESA

N88-10270# Technische Univ., Berlin (West Germany). Fachbereich Elektrotechnik.
MEASURING TECHNICAL AND MATHEMATICAL INVESTIGATIONS OF MULTIPLE REIGNITIONS AT THE SWITCHING OF A MOTOR USING VACUUM CIRCUIT BREAKERS Ph.D. Thesis [MESSTECHNISCHE UND RECHNERISCHE UNTERSUCHUNG VON MULTIPLEN WIEDERZUENDUNGEN BEIM SCHALTEN VON MOTOREN MIT VAKUUMSCHALTERN]
Andreas Luxa 1987 174 p In GERMAN; ENGLISH summary
(ETN-87-90406) Avail: NTIS HC A08/MF A01

The necessary conditions in switching system and vacuum circuit breaker for the occurrence of multiple re-ignitions and accompanying effects were examined. The shape of the occurring voltages was determined in relationship to other types of overvoltage. A phenomenological model of the arc, based on an extension of the Mayr equation for arcs was used with the simulation program NETOMAC for the switching transients. Factors which affect the arc parameters were analyzed. The results were statistically verified by 3000 three-phase switching tests on 3 standard vacuum circuit breakers under realistic systems conditions; the occurring overvoltage level was measured. Dimensioning criteria for motor simulation circuits in power plants were formulated on the basis of a theoretical equivalence analysis and experimental studies. The simulation model allows a sufficiently correct estimation of all effects. ESA

N88-10271# Technische Univ., Munich (West Germany). Lehrstuhl fuer Energiewirtschaft und Kraftwerkstechnik.
DEVELOPMENT OF METHODS FOR THE ANALYSIS OF THE FREQUENCY AND VOLTAGE STATICS OF ELECTRICITY USERS AND ELECTRICAL NETWORKS Ph.D. Thesis [ENTWICKLUNG VON METHODEN ZUR ANALYSE DER FREQUENZ- UND SPANNUNGSSTAKIK ELEKTRISCHER VERBRAUCHER UND NETZE]
Josef Dollinger 1985 145 p In GERMAN
(ETN-87-90412) Avail: NTIS HC A07/MF A01

Two methods that allow predictions concerning the effect of varying frequency and/or voltage on the real power requirements of partial networks, are presented. Measuring and data processing techniques were developed. The first method determines the respective single-user frequency and voltage statics, and the behavior of global user complexes by discrete superposition. The second method analyzes the network of a series of singly switchable networks. The first method provides valuable predictions concerning the range of the statics of electrical consumer apparatus and systems. The second method is complementary, but requires an important measuring effort. The results show that the user real power is reduced by 2%/Hz for a frequency reduction; the voltage-dependent power variations are 0.47%/V. ESA

N88-10272# Royal Aircraft Establishment, Farnborough (England).
LOW FREQUENCY IF TRANSFORMER DESIGNS HAVING VARIABLE COUPLING
J. L. Johnston Mar. 1987 21 p
(RAE-TM-RAD-NAV-291; BR102599; ETN-87-90954) Copyright
Avail: NTIS HC A03/MF A01

It is shown how to design low intermediate-frequency transformers using Vinkor pot cores at 400 kHz. The introduction of variable coupling is concentrated upon. It is emphasized that a loosely-coupled transformer can act as a negative impedance converter. ESA

N88-10273# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
OPTIMIZATION OF MODE CONVERTERS FOR GENERATING THE FUNDAMENTAL TE(06) GYROTRON OUTPUT AT 140 GHz
H. Kumric, M. Thumm, and R. Wilhelm Mar. 1987 36 p Submitted for publication
(IPF-87-1; ETN-87-91016) Avail: NTIS HC A03/MF A01

Oversized high-power mode converters were designed to transform the TE06 output mode of a 140 GHz gyrotron into the fundamental circular symmetric TE01 mode for low-loss propagation and further conversion to the perfectly linearly polarized quasi-optical HE11 hybrid mode. The improved perturbation structures of the rippled-wall mode converters were optimized by numerically integrating the proper coupled-wave differential equations. Three types of mode transformation schemes were investigated: (1) step-by-step conversion, (2) direct conversion, and (3) two-step conversion. In all cases the predicted conversion efficiency is 98%. Type (1) transducer exhibits a relatively broad bandwidth but is very long (total length L = 4.2 m) whereas the type (2) transformer is short (L = 1.8 m) but has an extremely narrow bandwidth. The two-step converter (3) realizes a compromise with respect to bandwidth. The low-power experimental data for conversion scheme (1) at frequencies 70 and 150 GHz are in excellent agreement with computed values. ESA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N88-10274 British Petroleum Co. Ltd., London (England).
ELECTRICAL HEATING METHOD Patent Application
Russell Ian Crisp, inventor and Sidney George Fogg, inventor 26 Sep. 1984 3 p Filed 12 Mar. 1984 Priority 26 Mar. 1983 GB 8308383
(GB-Patent-2-137-059-A; GB-Patent-Appl-SN-8406398; Int-Patent-Class-H05B-3/40; ETN-86-98029) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

An electrical method for heating metal pipes or tanks is proposed. It comprises coating the metal surface to be heated with a conducting polyester composition, positioning an electrode in electrical contact with the conducting polyester such that the electrode and metal surface are separated by the conducting polyester composition, and applying an electrical current between the electrode and the metal surface. The invention includes a metal pipe adapted to be heated by the method. ESA

N88-10275*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
EFFECTS OF FORCED AND FREE CONVECTIONS ON STRUCTURAL TEMPERATURES OF SPACE SHUTTLE ORBITER DURING REENTRY FLIGHT
William L. Ko, Robert D. Quinn, and Leslie Gong Oct. 1986 14 p Presented at the AIAA 22nd Thermophysics Conference, Honolulu, Hawaii, 8-10 Jun. 1987 Revised
(NASA-TM-86800; H-1414; NAS 1.15:86800; AIAA-87-1600)
Avail: NTIS HC A03/MF A01 CSCL 20D

Structural performance and resizing (SPAR) finite element thermal analysis computer programs was used in the heat transfer analysis of the space shuttle orbiter wing subjected to reentry aerodynamic heating. With sufficient external forced convective cooling near the end of the heating cycle, the calculated surface temperatures of the thermal protection system (TPS) agree favorable with the flight data for the entire flight profile. However, the effects of this external forced convective cooling on the structural temperatures were found to be negligible. Both free and forced convection elements were introduced to model the internal convection effect of the cool air entering the shuttle interior. The introduction of the internal free convection effect decreased the calculated wing lower skin temperatures by 20 F, 1200sec after touchdown. If the internal convection is treated as forced convection, the calculated wing lower skin temperatures after touchdown can be reduced to match the flight measured data. By reducing the TPS thicknesses to certain thicknesses to account for the TPS gap heating, the calculated wing lower skin temperatures prior to touchdown can be raised to agree with the flight data perfectly. Author

N88-10276 North Carolina State Univ., Raleigh.
ACCURATE, STABLE, EXPLICIT SOLUTION OF THE PARABOLIZED NAVIER-STOKES EQUATIONS Ph.D. Thesis
Thomas Paul Gielda 1987 111 p
Avail: Univ. Microfilms Order No. DA8711600

A stable, accurate and efficient implementation of MacCormack's explicit algorithm for the Parabolized Navier-Stokes (PNS) equations is demonstrated. The familiar problem of decoding

the conservative axial flux factor is solved, resulting in accurate, smooth dependent variable profiles through the viscous layer sonic line. Source terms due to transformation of the parabolized governing functions into the computational plane and the resultant metric differencing have been identified and eliminated through inclusion of the appropriate geometric conservation law terms. Test cases computed include two- and three-dimensional supersonic and hypersonic flow at laminar and turbulent Reynolds numbers. The computed results demonstrate very good agreement with experiment and solutions of the full Navier-Stokes equations. Computational times required for the MacCormack explicit PNS code are approximately equal to those of existing implicit PNS solvers. The explicit PNS code proved to be sufficiently robust to allow initializing the computation from free stream conditions. In addition, little or no added damping is required once the initial starting transients have been reduced. Dissert. Abstr.

N88-10277# Los Alamos National Lab., N. Mex.
HOT-SPOT REACTION IN UNSUSTAINED SHOCKS
J. N. Johnson 1987 5 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-36)
(DE87-011781; LA-UR-87-1964; CONF-870753-12) Avail: NTIS HC A02

Shock waves in reactive media create hot spots which undergo further temperature change (following creation) by means of: (1) chemical reaction, (2) thermal conduction, and (3) adiabatic effects resulting from pressure variation. A thermodynamic description of exothermic reaction under conditions of variable pressure is presented here. The reaction rate is assumed to be a function of temperature only, and of the Arrhenius form: the effect of variable pressure enters through its influence on temperature. Decreasing pressure significantly alters adiabatic thermal explosion times, and can, under nominal conditions, completely inhibit hot-spot reaction. This effect is discussed in terms of explosive initiation by unsustained shock waves. DOE

N88-10278# European Space Agency, Paris (France).
EXPERIENCE ABOUT THE APPLICATION AND VALUATION OF ROUGHNESS STRIPS FOR BOUNDARY LAYER TRANSITION CONTROL IN WIND TUNNEL TESTS IN THE HIGH-SPEED RANGE
Sieghard Tusche Mar. 1987 93 p Transl. into ENGLISH of Erfahrungen ueber die Anwendung und Beurteilung von Rauhigkeitsstreifen zur Beeinflussung des Grenzschichtumschlags bei Windkanalversuchen im Hochgeschwindigkeitsbereich (Goetingen, Fed. Republic of Germany, DFVLR) 1986 Original language document announced as N87-14291
(ESA-TT-1028; DFVLR-Mitt-86-12; ETN-87-90664) Avail: NTIS HC A05/MF A01; original report in German available from DFVLR, Cologne, West Germany DM 56

Placing and application of artificial transition strips for aerodynamic tests are described. Methods used in high-speed wind tunnels for checking the effectiveness of transition strips are given. ESA

N88-10279# Royal Aircraft Establishment, Farnborough (England).
AN INVISCID MODEL OF PLANAR, SEPARATED FLOWS OF FINITE EXTENT
N. Riley and R. E. Shaw Nov. 1986 26 p
(Contract MOD(PE)-2162/013)
(RAE-TR-86070; RAE-AERO-3623; BR102159; ETN-87-90701)
Copyright Avail: NTIS HC A03/MF A01

A treatment for the equations for two dimensional, inviscid, incompressible flow when the flow region contains a separation bubble of finite length is presented. Outside the separated flow region small-disturbance theory is used to solve the potential-flow equations. Within the separation bubble, where the flow is assumed to have uniform vorticity, the slender-eddy approximation of Childress (1966) is employed. The solution is completed by matching the pressure across the vortex sheet that divides the two regions of flow. Solutions for the flow past trenches and backward facing steps are given. ESA

N88-10280# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
RAYLEIGH-BENARD CONVECTION IN A HELE-SHAW CELL: A NUMERICAL STUDY
C. Guenther and U. Mueller May 1987 60 p
(KfK-4212; ISSN-0303-4003; ETN-87-90788) Copyright Avail: NTIS HC A04/MF A01

Using a simplified form of the Boussinesq equations and a finite difference scheme the free convective flow in a Hele-Shaw cell of small aspect ratio h/b = 3.5 was calculated. The calculations result in realistic values for the critical Rayleigh numbers for the onset of steady and oscillatory convection. Most of the observed unsteady flow patterns can be simulated numerically. It is shown that five different stable flow patterns can occur at one particular Rayleigh number. The different stable flow patterns are coupled by a variety of complex transitions. The calculations show that a realistic description of the observed flow phenomena can not be obtained by a simplified model using the Darcy law in the momentum equation and implying slip flow at the small confining boundaries. ESA

N88-10281 Gesellschaft fuer Mathematik und Datenverarbeitung, St. Augustin (West Germany). Inst. fuer Methodische Grundlagen.
GENERATION OF BODY-FITTED GRIDS FOR TWO DIMENSIONAL INTERIOR DOMAINS BY THE SOLUTION OF A SYSTEM OF POISSON EQUATIONS USING MULTIGRID TECHNIQUES
Romesh K. Jain Apr. 1987 84 p Sponsored by Suprenum G.m.b.H.
(GMD-246; ISSN-0723-0508; ETN-87-90799) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

A boundary-fitted grid generator for computational fluid dynamics was developed. Full approximation storage is used with the fine grid starting solution obtained by the full multigrid (MG) algorithm. Highly anisotropic conditions arising in the equations due to the attraction of grid lines towards the boundaries are tackled using alternating line relaxation for smoothing the high frequency error components and for the solution in the coarsest grid. The inhomogeneous terms or the forcing functions of the governing equations which control the grid lines spacing are derived from the boundary point distributions. Numerical experiments show that MG efficiency is nearly independent of the degree of clustering of grid lines if alternating line relaxation is used for smoothing the high frequency error components. Compared to the solution of Laplace equations, the use of inhomogeneous terms for very strong clustering of grid lines improves the solution efficiency as it provides grid stress relief. ESA

N88-10282# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
ARSPNS: A METHOD TO CALCULATE STEADY AND UNSTEADY POTENTIAL FLOW ABOUT FIXED AND ROTATIONAL LIFTING AND NONLIFTING BODIES
M. H. L. Hounjet 1985 42 p Sponsored by the Project Management Bureau for Energy Research of the National Development Program on Wind Energy
(NLR-TR-85114-U; B8709825; ETN-87-90822) Avail: NTIS HC A03/MF A01

A panel method for the calculation of steady and time-linearized unsteady incompressible potential flow about arbitrary lifting and nonlifting bodies in an arbitrary mean steady flow field, including rotation is described. Applications to wind turbines including the effects of tipvanes were made. An integation scheme for obtaining the loads which contain implicitly the suction force in the case of a lifting surface approximation and which should improve the drag prediction in a full body approximation is applied. ESA

N88-10283# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
MEASUREMENT TECHNIQUES IN LOW-SPEED TURBULENT FLOWS: A REPORT ON EUROMECH 202
B. vanderBerg and A. Bertelrud 5 Jun. 1986 17 p Presented at the EUROMECH 202 Colloquium, Marknesse, The Netherlands, 7-10 Oct. 1985
(NLR-MP-86038-U; B8701065; ETN-87-90828) Avail: NTIS HC A03/MF A01

Measurement techniques in low speed turbulent flows and typical swept wings were discussed. Wakes were included. ESA

N88-10284# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
BREAKDOWN OF STEADY AND UNSTEADY INTERACTING BOUNDARY LAYERS
R. A. W. M. Henkes and A. E. P. Veldman 24 Jul. 1986 18 p Presented at the IUTAM Symposium on Boundary Layer Separation, London, United Kingdom, 26-28 Aug. 1986
(NLR-MP-86047-4; B8707398; ETN-87-90829) Avail: NTIS HC A03/MF A01

Instabilities encountered in interacting boundary-layer calculations of steady flow past an indented plate, which might be related to the breakdown of the marginal separation, are identified as numerical. It is shown that the unsteady interacting boundary-layer approach delays Van Dommelen's singularity in the classical boundary layer around the impulsively started cylinder. The calculations show the experimentally known individualization of a vortex, after which the solution grows without reaching a steady limit; a process which is likely to be related to dynamic stall. ESA

N88-10285# Los Alamos National Lab., N. Mex.
MEMBRANE HEAT PIPE DEVELOPMENT FOR SPACE RADIATOR APPLICATIONS
K. Woloshun and M. Merrigan 1986 7 p Presented at the 3rd Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 13 Jan. 1986
(Contract W-7405-eng-36)
(DE86-006015; LA-UR-86-145; CONF-860102-17) Avail: NTIS HC A02/MF A01

A self-deploying membrane heat pipe (SMHP) is being designed and fabricated to operate in an in-cabin experiment aboard a STS flight. The heat pipe comprises a mylar membrane with a woven fabric arterial wick and R-11 as the working fluid. Preliminary results indicate that this SMHP design will successfully expand and retract in response to an applied heat load; the retraction force is provided by a constant force spring. DOE

N88-10286# Argonne National Lab., Ill.
NONINTRUSIVE ULTRASONIC FLOW MEASUREMENT TECHNIQUES AND THEIR APPLICATIONS TO BTU METERING
S. H. Sheen, D. E. Karvelas, and A. C. Raptis Apr. 1987 11 p Presented at the 78th International District Heating and Cooling Association Conference, Baltimore, Md., 21 Jun. 1987
(Contract W-31-109-eng-38)
(DE87-011390; CONF-870621-1) Avail: NTIS HC A03/MF A01

The paper reviews the state-of-the-art ultrasonic flow measurement techniques and assesses their potential application to BTU metering for District Heating and Cooling (DHC). The assessed techniques include Doppler, transit-time, and cross-correlation ultrasonic flowmeters which are currently available on the market. A novel modification of the flow instruments to include temperature measurement is also discussed. The modified flowmeter provides a direct measurement of heat content in hot water flow, thus, it allows one to meter the BTU consumption of a DHC system. DOE

N88-10287# Argonne National Lab., Ill.
BLOWDOWN OF TWO-COMPONENT GAS MIXTURES IN BRANCHING SYSTEMS
C. W. Solbrig 1987 13 p Presented at the Numerical Methods in Laminar and Turbulent Flow, Montreal, Quebec, 6 Jul. 1987
(Contract W-31-109-eng-38)
(DE87-011392; CONF-870712-4) Avail: NTIS HC A03/MF A01

A transient multi-volume, two-component model has been developed which is capable of describing the blowdown of gases through a piping system suddenly opened to the atmosphere. The volumes are connected through orifices or nozzles with recovery sections and in tee configurations as well as a single string. Two gas components are included in the model and exhaust into a third component such as air. Motion of a concentration front is modelled and a polytropic process represents the state of the gas in each volume. An implicit solution is required since explicit numerical solutions are unstable for these equations. The iterative method developed for the equations converges in a variety of ill-posed situations. Results compare well with data. The large difference in the critical velocities of the gases results in very unusual and difficult to model depressurization histories. A local minimum in the pressure is observed followed by a later maximum. DOE

N88-10288# Los Alamos National Lab., N. Mex.
NASA-VOF3D: A THREE-DIMENSIONAL COMPUTER PROGRAM FOR INCOMPRESSIBLE FLOWS WITH FREE SURFACES
M. D. Torrey, R. C. Mjolsness, and L. R. Stein Jul. 1987 192 p
(Contract W-7405-eng-36)
(DE87-011849; LA-11009-MS) Avail: NTIS HC A09/MF A01

Presented is the NASA-VOF3D three-dimensional, transient, free-surface hydrodynamics program. This three-dimensional extension of NASA-VOF2D will, in principle, permit treatment in full three-dimensional generality of the wide variety of applications that could be treated by NASA-VOF2D only within the two-dimensional idealization. In particular, it, like NASA-VOF2D, is specifically designed to calculate confined flows in a low g environment. The code is presently restricted to cylindrical geometry. The code is based on the fractional volume-of-fluid method and allows multiple free surfaces with surface tension and wall adhesion. It also has a partial cell treatment that allows curved boundaries and internal obstacles. This report provides a brief discussion of the numerical method, a code listing, and some sample problems. DOE

N88-10289# Sandia National Labs., Albuquerque, N. Mex.
TIME-RESOLVED MEASUREMENTS OF SHOCK-INDUCED VAPOR-PRESSURE PROFILES
J. R. Asay, T. G. Trucano, and L. C. Chhabildas 1987 7 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012972; SAND-87-0648C; CONF-870753-43) Avail: NTIS HC A02/MF A01

This paper describes the use of time-resolved interferometric techniques for direct measurement of the stagnation pressure histories produced by rapidly expanding vapors. The technique has been used to study the shock-induced vaporization of polymethyl methacrylate (PMMA), cadmium and lead. The experimental technique and preliminary data obtained on these materials are discussed. DOE

N88-10290# Japan Atomic Energy Research Inst., Tokyo.
RESEARCH ON ONE-DIMENSIONAL TWO-PHASE FLOW. THEORY ON HYDRODYNAMIC BALANCE IN TWO FLUID MODEL AND ITS APPLICATION
H. Adachi Aug. 1986 180 p In JAPANESE
(DE87-702615; JAERI-M-86-118) Avail: NTIS (US Sales Only) HC A09/MF A01

In the Part I, the author describes the fundamental form of the hydraulic basic equations for a one-dimensional two-phase flow (two fluid model). Most of the discussions are concentrated on the treatment of phase change inertial force terms in the equations of motion, and the author's equations of motion have a strong uniqueness on the following three points in comparison

with conventional equations of motion: (1) To express force balance of unit mass two-phase fluid instead of that of unit volume two-phase fluid; (2) To pick up the unit existing mass and the unit flowing mass as the unit mass of two-phase fluid; and (3) To apply the kinetic energy principle instead of the momentum low in the evaluation of stational inertia force term. In these three, the item: (1) is for excluding a part of momentum change or kinetic energy change due to mass change of the elementary part of fluid, which is independent of force; (2) is not to introduce a phenomenological physical model into the evaluation of phase change inertial force term; and (3) is for correctly applying the momentum law taking into account the difference of representative velocities between the main flow fluid (vapor phase or liquid phase) and the phase change part of fluid. In the Part II, characteristics of various kinds of high speed two-phase flow are clarified theoretically by using the basic equations derived in the Part I. DOE

N88-10291# Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (East Germany).
INFLUENCE OF A MAGNETIC FIELD ON THE DIFFUSION OF SMALL PARTICLES IN A TURBULENT FLOW
G. Gerbeth and D. Hamann Aug. 1986 12 p
(DE87-702877; ZfK-601) Avail: NTIS (US Sales Only) HC A03/MF A01

The asymptotic diffusion coefficient tensor of suspended small particles in a turbulent flow is predicted. The contribution from the Basset history force in the equation of motion is investigated. Crossing trajectory effects are taken into account. The influence of a homogeneous external magnetic field on the diffusion coefficient is calculated for non-conducting suspended particles. The magnetic field is taken into account by its influence on the fluid velocity correlation tensor. The diffusion coefficient tensor is anisotropic due to the two preferred directions of the system, namely, the directions of the magnetic field and the deterministic particle velocity v/sub 0/. The obtained diffusion coefficients show an unexpected dependence on the parameter beta = u/sub 0//v/sub 0/. DOE

N88-10292 Oregon State Univ., Corvallis.
PERFORMANCE OF ROTARY REGENERATIVE HEAT EXCHANGER: A NUMERICAL SIMULATION Ph.D. Thesis
Young Lib Bae 1987 149 p
Avail: Univ. Microfilms Order No. DA8713102

The transient and steady-state temperature performance of a rotary regenerative heat exchanger is examined. In contrast to previous studies on this problem, fluid flow in the circumferential direction was considered. Appropriate modeling was included to measure the effect of carry-over on the differential equations describing mass and energy conservation. The energy equations describing transient temperature profiles in two spatial dimensions were derived from the general case. These energy equations were then non-dimensionalized for the case where both fluids were identical, producing the appropriate parameters for evaluating performance. A step-by-step system was obtained in explicit form for the matrix temperature using upstream differencing methods. The errors for this numerical system were analyzed and a necessary condition for stability was obtained. Sample problems for balanced and symmetrical cases were solved and the effect of carry-over and matrix rotation speed on performance was discussed. A parameter representing the effects of carry-over was suggested. Dissert. Abstr.

N88-10293 City Univ. of New York, N.Y.
EXPERIMENTAL STUDY OF THREE-DIMENSIONAL TURBULENT JET-SOLID BOUNDARY INTERACTION Ph.D. Thesis
Christos D. Tsitouras 1987 219 p
Avail: Univ. Microfilms Order No. DA8713805

A comprehensive experimental study was carried out to investigate jet boundary interaction of blocked 3 dimensional turbulent air jets discharging offset and the parallel to a solid boundary. The study was undertaken to establish the general flow and thermal characteristics associated with this configuration. Attention was focused on surface pressure distribution, jet trajectory and velocity and temperature distributions. Three outlets of aspect ratio, 0.1, 0.25, and 0.44, as well as the 2 dimensional case (e=0) were investigated at offset distances ranging from 0 (wall jet) to infinity (free jet). The discharge Reynolds number ranged from 26,000 to 55,000. Flow visualization was used to determine gross jet spread behavior as well as the reattachment location. Mapping of surface pressure revealed a complex 2 dimensional pattern of sub-ambient and above ambient pressure distribution. Comparisons between 3 dimensional and 2 dimensional jets showed similarities as well as significant differences. Similarities at asymptotic conditions associated with the discharge aspect ratio e and offset distance h were examined. Dissert. Abstr.

N88-10294# National Bureau of Standards, Gaithersburg, Md. Center for Fire Research.
COOLING EFFECT OF A SINGLE EVAPORATING DROPLET ON A HOT SEMI-INFINITE METAL BODY
M. diMarzo, D. D. Evans, and A. K. Trehan Apr. 1987 30 p
Sponsored by Maryland Univ., College Park
(PB87-201802; NBSIR-87/3517) Avail: NTIS HC A03/MF A01 CSCL 13B

Transient cooling of solid surfaces by water droplet evaporation was investigated through controlled experiments using a large heated aluminum cylinder. Quantitative prediction of droplet evaporation time and in-depth transient temperature distribution in the solid were made. All data, regardless of the droplet volume or of the initial body surface temperature, lie within a narrow band about a straight line. This finding is the first important step to obtain a simple model for spray cooling based on local accurate description of the droplet-solid interactions. Modeling of spray cooling phenomena is the foundation for the construction of a thermal model for solid fuel fire extinguishment. GRA

N88-10295# Colorado Univ., Boulder. Dept. of Astrophysical, Planetary, and Atmospheric Sciences.
TWO-DIMENSIONAL SHEAR FLOW TURBULENCE: A STATISTICAL THEORY OF VORTEX FILAMENTS
T. Chiueh, P. W. Terry, and P. H. Diamond May 1987 42 p
Prepared in cooperation with Texas Univ., Austin
(Contract DE-FG05-80ET-53088)
(DE87-012234; DOE/ET-53088/270; IFSR-270) Avail: NTIS HC A03/MF A01

A theory of two-dimensional free shear flow turbulence is proposed. In particular, the role of interactions of fluctuations with the mean flow is distinguished from that of interactions among fluctuations. The former are responsible for the extraction of free energy necessary for maintaining the turbulence, while the latter lead to the enstrophy cascade which generates small-scale eddies. On the length scales of greatest interest, turbulence is anisotropic because of the influence of mean flow shear. At smaller scales, self-similar enstrophy transfer occurs and yields the familiar power law spectrum. Free energy extraction is accompanied by mean flow relaxation. Two distinct mechanisms are involved. In addition to the usual quasilinear diffusion, there is a nonlinear drift which acts to enhance localized fluctuations and flatten the mean flow profile. The saturated state is characterized by collective resonances which must be nonlinearly damped in order to balance their generation by seed-eddy induction. This balance gives rise to a condition for the determination of the nonlinear damping rate, and thus the turbulence level. The spatial structure of the saturated fluctuations is also predicted. DOE

N88-10296# Lawrence Livermore National Lab., Calif.
THEORETICAL APPROACHES TO CHEMICAL DYNAMICS IN HIGHLY COMPRESSED FLUIDS
D. F. Calef 1 Jul. 1987 8 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-48)
(DE87-012242; UCRL-96930; CONF-870753-21) Avail: NTIS HC A02/MF A01

Methods that have been developed in the chemical physics community over the previous decade are applied to problems involving the dynamic chemical behavior of fluids under highly compressed conditions. The methods require detailed structural information about the environment seen by the reacting molecules. These methods are briefly reviewed. Examples for both statically compressed and shock conditions are discussed. DOE

N88-10297# Lawrence Livermore National Lab., Calif.
RAYLEIGH-TAYLOR INSTABILITY IN COMPRESSIBLE FLUIDS Final Report, 1 Oct. 1985 - 30 Sep. 1986
B. Sturtevant Oct. 1986 25 p Prepared in cooperation with California Inst. of Tech., Pasadena
(Contract W-7405-eng-48)
(DE87-013494; UCRL-15926) Avail: NTIS HC A03/MF A01

The purpose of this research program is to investigate fluid dynamic instabilities and mixing initiated by the interaction of shock waves with interfaces between light and heavy gases. In particular, the nonlinear stage of shock-initiated Rayleigh-Taylor instability (also known as the Richtmeyer-Meshkov instability), the secondary instabilities (e.g., the Kelvin-Helmholtz instability) arising therefrom and the resulting mixing of the two gases are of interest. This report describes activities during the performance period 1 October 1985 to 30 September 1986. DOE

N88-10298# Argonne National Lab., Ill.
TWO-PHASE NON-NEWTONIAN HYDRODYNAMIC MODELING OF SLURRIES
C. S. Wang, R. W. Lyczkowski, and G. F. Berry 1987 20 p Presented at the 12th International Conference on Slurry Technology, New Orleans, La., 30 Mar. 1987
(Contract W-31-109-eng-38)
(DE87-011519; CONF-870324-1) Avail: NTIS HC A03

The two-phase hydrodynamic theory of fluid/solid flow has been extended to incorporate the constitutive relationship for power-law non-Newtonian behavior. A model has been developed to predict the spatial and temporal variations in solids and liquid velocities and concentration of non-Newtonian slurries under high shear rates in diesel engine injection systems. Comparisons between the present non-Newtonian two-phase theory and the conventional theory have also been made. Selected results for diesel injection nozzle applications are presented. The results from this model can be used to calculate directly the erosion rates at the nozzle boundaries and the solids loading at the nozzle exit. DOE

N88-10299# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
EXPERIMENTAL AND THEORETICAL STUDIES OF VERTICAL ANNULAR LIQUID JETS Technical Report
N. Chigier, J. I. Ramos, and T. Y. Sun Apr. 1987 112 p
(Contract DE-FG02-86ER-13597)
(DE87-013907; DOE/ER-13597/1; TR-1) Avail: NTIS HC A06/MF A01

Research being conducted on annular liquid jets is described. The fluid mechanics of liquid curtains are being studied experimentally. This includes measurement of liquid film thickness, liquid film velocity and convergence length as a function of curtain diameter, nozzle gap width, liquid flow rate, and variation of physical properties of the liquid. A mathematical model, based on analytical and numerical solutions, which accounts for gravity, surface tension, pressure differences and exit nozzle geometry is presented in this report. DOE

N88-10300# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
PROBLEM SPECIFICATIONS AND COLLATED SOLUTIONS OF THE TWO-PHASE NUMERICAL-BENCHMARK EXERCISE 1986-7
D. Brian Spalding, ed., Liu Jun, Heqing Qin, Dejan Radosavljevic, Kate Taylor, Francisco Villasenor, ed., M. C. Walsh, and Zhenya Wu Feb. 1987 244 p Presented at the Second International Workshop on Two-Phase Flow Fundamentals, Troy, N.Y., 16-20 Mar. 1987
(CFDU/87/1; ETN-87-90691) Avail: NTIS HC A11/MF A01

Solutions to numerical-benchmark problems concerning one and two-dimensional two-phase flows, with and without time dependence are compared. Numerical solutions were submitted by 9 teams, from 5 countries, using different computational procedures and computer codes. ESA

N88-10301# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
MEAN FLOW STRUCTURE OF A TURBULENT JUNCTION VORTEX Interim Report
F. J. Pierce, C. M. Kim, and M. D. Harsh Apr. 1987 259 p
(Contract N00014-86-K-0036)
(PB87-206231; VPI-E-87-6) Avail: NTIS HC A12/MF A01
CSCL 20D

The mean flow structure upstream, around, and within a turbulent junction or horseshoe vortex is reported for an incompressible, subsonic flow. Measurements of the primitive variables of velocity and pressure are reported on all surfaces bounding the region of the vortex flow, and on one transverse and one streamwise plane within the flow field itself for comparisons between the measured and calculated flow variables. The data are a highly detailed, coherent, self consistent set offered to the computational fluid mechanics community as a standard test case for the evaluation of the predictive capability of numerical solvers intended for predicting the flow field in such a complex, separated, three-dimensional turbulent flow. GRA

N88-10302# Technische Univ., Munich (West Germany). Fakultaet fuer Maschinenwesen.
NUMERICAL CALCULATION OF THE TURBULENT FLOW ABOUT A CUBIC BODY Ph.D. Thesis [NUMERISCHE BERECHNUNG DER TURBULENTEN UMSTROEMUNG EINES KUBISCHEN KOERPERS]
Frank Baetke 1986 245 p In GERMAN
(ETN-87-90418) Avail: NTIS HC A11/MF A01

The calculation of the three-dimensional flow about sharp-angular bodies using numerical methods was investigated, for engineering applications. Discretization methods and approaches to the modeling of turbulence phenomena were compared. Based on finite differences and statistical turbulence models, a solution algorithm which can take into account complicated boundary geometries was deduced. The possibility of complete vectorization enables an extensive use of powerful computer architecture. The efficiency of the algorithm is demonstrated by calculating the turbulent flow field near a cubic body on a plate. ESA

N88-10303# Kaiserslautern Univ. (West Germany). Fachbereich Maschinenwesen.
DETERMINATION OF THE DYNAMIC PARAMETERS OF ANNULAR CLEARANCES WITH TURBULENT FLOW AND INCOMPRESSIBLE MEDIA Ph.D. Thesis [ERMITTLUNG DER DYNAMISCHEN PARAMETER TURBULENT DURCHSTROEMTER RINGSPALTE BEI INKOMPRESSIBLEN MEDIEN]
Harald Massmann 1986 105 p In GERMAN
(ETN-87-90434) Avail: NTIS HC A06/MF A01

The parameters of annular clearances with a fluid flow, used as joints in several forms between turbopump spaces with different pressure levels, were investigated. The status of the theoretical models treating such flows is reviewed. A measuring method for the determination of the dynamic annular clearance coefficients was developed, providing a fast frequency response and good results. An iteration method was developed for the reduction of the measured information to the required parameters. The measuring results obtained on a test stand demonstrate the limitations of the measuring apparatus, but corroborate the theoretical data. ESA

N88-10304# Gesamthochschule, Essen (West Germany). Fachbereich Maschinentechnik.
CALCULATION OF THE EIGENVIBRATIONS OF AXISYMMETRIC FLUID CONFIGURATIONS WITH A SINGULARITY METHOD, TAKING INTO ACCOUNT SURFACE TENSION EFFECTS UNDER REDUCED GRAVITY Ph.D. Thesis [BERECHNUNG DER EIGENSCHWINGUNGEN AXIALSYMMETRISCHER FLUESSIGKEITSKONFIGURATIONEN IN TANKS MIT EINEM SINGULARITAETENVERFAHREN UNTER BERUECKSICHTIGUNG VON OBERFLAECHENSPANNUNGSEFFEKTEN BEI REDUZIERTER SCHWERE]
Ulrich Schilling 1985 175 p In GERMAN Sponsored by the Ministeriums fuer Wissenschaft und Forschung des Landes Nordrhein-Westfalen, West Germany
(ETN-87-90438) Avail: NTIS HC A08/MF A01

The use of the singularity method for the calculation of fluid vibrations under reduced gravity, due to surface tension effects was investigated, starting from the basic flow equations of an incompressible, inviscid fluid. Examples show that problems with a Liapunov boundary plane can be very well solved numerically, as well as problems with a stuck-edge boundary behavior in the corners. Free-edge problems require solutions especially adapted to the geometry. The method is less suited for the calculation of fuel motions in satellite tanks, but useful for the study of the dynamic behavior of nonrotating fluid configurations. ESA

N88-10305# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung fuer Turbinen und Schaufelkuehlung.
COMPARISON OF DIFFERENT KINDS OF COMPACT CROSS FLOW HEAT EXCHANGERS
Werner Siemens Sep. 1986 82 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-1076)
(DFVLR-FB-86-63; ISSN-0171-1342; ETN-87-90448) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany

A computer program for the calculation of compact heat exchangers for gas turbines was developed. The most important coefficients, pressure drops, and effectiveness of different kinds of exchangers were calculated as a function of Mach number, the dimensions of the exchanger, and the compactness. From the aerothermodynamic point of view, the plate exchanger is best, closely followed by the lancet heat exchanger. The ribs of the plate version have no significant effect on the characteristics, but are required for stiffness and uniform channel height. The tube heat exchanger can only compete as far as the transferable heat is concerned. ESA

N88-10306# Los Alamos National Lab., N. Mex.
PHASE DYNAMICS: A REVIEW AND A PERSPECTIVE
H. R. Brand 1987 33 p Presented at the Workshop on Propagative Nonequilibrium Patterns, Les Houches, France, 1 Mar. 1987 Prepared in cooperation with Essen Univ., West Germany (Contract W-7405-eng-36)
(DE87-013173; LA-UR-87-2554; CONF-8703165-1) Avail: NTIS HC A03/MF A01

The present status of phase dynamics, the analog of hydrodynamics for large aspect-ratio pattern forming non-equilibrium systems was reviewed. Low frequency, long wavelength excitations in systems such as the regular patterns which arise in the Taylor instability (a simple fluid in the gap between two concentric cylinders was subjected to a torque by rotating the inner or both cylinders) or the Benard instability (a thin layer of fluid heated from below) was examined and the question of nonlinear excitations such as solitary waves addressed. The connection between the phenomenological parameters arising in the phase equations and results obtained from amplitude equations valid close to the onset of a specific pattern were investigated. Suggestions for experiment to test further the concept of phase dynamics have also been included. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N88-10307 British Petroleum Co. Ltd., London (England).
BALANCING STRAIN GAUGE BRIDGES Patent Application
Laurence Geoffrey Cuthbert, inventor 16 May 1984 3 p Filed 3 Nov. 1983 Priority 4 Nov. 1982 GB 8231507
(GB-Patent-2-129-567-A; GB-Patent-Appl-SN-8329439; Int-Patent-Class-G01L-1/22; Int-Patent-Class-G01R-17/10; ETN-86-98026) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1AY, United Kingdom

A strain-gauge bridge network comprising binary-weighted resistors, i.e., successive resistors have a two to one ratio, interconnected by links which can be severed in situ to provide a required balance for the bridge network, is proposed. The network is suitable for balancing strain gauge bridges attached to piles anchoring offshore platforms. ESA

N88-10308 British Petroleum Co. Ltd., London (England).
CRYOGENIC CELL Patent Application
David William Mellor, inventor 14 Nov. 1984 4 p Filed 13 Apr. 1984 Priority 16 Apr. 1983 GB 8310365
(GB-Patent-2-139-745-A; GB-Patent-Appl-SN-8409627; Int-Patent-Class-F25D-3/00; ETN-86-98030) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1AY, United Kingdom

A cryogenic cell comprising a sealed external annular chamber, adapted to vacuum, enclosing totally a sealed inner chamber for the storage of a solid/liquid refrigerant is proposed. The external chamber has a well in its upper region immediately above and in contact with the top of the inner chamber, which is connected at its lower end to a section containing an adsorbent, the latter being connected at its lower end to a further chamber adapted for the reception of a radiation detector. The cell is suitable for use in maintaining the semiconductor detector of a neutron logging tool at the required low temperature. ESA

N88-10309 Deutsche Geodaetische Kommission, Munich (West Germany).
STRAIN GAGES IN ENGINEERING GEODESY Ph.D. Thesis - Technische Hochschule, Darmstadt, West Germany [DEHNUNGSMESSSTREIFEN IN DER INGENIEURGEODAESIE]
Werner Frohwein 1986 88 p In GERMAN
(Ser-C-320; ISBN-3-7696-9370-1; ISSN-0065-5325; ETN-87-90358) Copyright Avail: Issuing Activity

The mechanical fundamentals of strain gages are presented. The application of strain gages using an extensometer as transfer system is discussed. An extensometer with Invar wire was developed. The stability of the Invar wire was tested, and a mathematical model was deduced. The effect of the catenary curve of the wire extensometer on the measurements was determined. The measuring bridges were calibrated. For testing, observations were made on a tower shaft. The measuring system proves to be fully functioning. The comparison between the observations and a theoretical model of the tower shaft behavior under solar radiation shows extensive agreement. ESA

N88-10310# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany). Abteilung Optik.
PHOTODIODE MATRIX FOR THE ANALYSIS OF TWO-BEAM INTERFERENCES [FOTODIODENMATRIX ZUR ANALYSE VON ZWEISTRAHLINTERFERENZEN]
Andreas Fricke Jan. 1987 28 p In GERMAN; ENGLISH summary
(PTB-Opt-23; ISSN-3-88-314-613-7; ISSN-0341-6712; ETN-87-90390) Avail: NTIS HC A03/MF A01

A photodiode matrix camera sytem was developed for two-beam interferometers. The setup, function, and the electronic circuitry of the camera system with 32 X 32 pixels, as well as its bus interface are described. The camera was optimized for high sensitivity in order to analyze the interference patterns of Michelson interferometers with very low intensity. Each computer is able to control this measuring system for image sensing, using a bus interface; the computer has only to realize the necessary standard functions of the bus system. ESA

N88-10311# Fraunhofer-Inst. fuer Toxikologie und Aerosolforschung, Schmallenberg-Grafschaft (West Germany).
AEROSOL SENSOR: REAL TIME DETERMINATION OF AEROSOL MASS SIZE DISTRIBUTORS USING FILTERING QUARTZ OSCILLATORS Final Report, Nov. 1985
Werner Hollander, Reinhard Brandt, Einhardt Pape, Michael Plachky, and Peter Vater Bonn, Fed. Republic of Germany Bundesministerium fuer Forschung und Technologie 1987 24 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn, Fed. Republic of Germany
(ETN-87-90397) Avail: NTIS HC A03/MF A01

The use of quartz crystals as filtering mass monitoring devices was investigated. The irradiation of quartz crystals 100 microns thick with heavy ions causes serious damage of the crystal along the irradiation path. By etching these quartzes with KOH as example, pores with adjustable diameters are obtained. The use of these quartzes for filtering mass monitoring shows a reduced Q-factor compared to untreated quartz; nevertheless they can be employed as oscillators. Their moisture sensitivity and temperature coefficients are similar to those of normal quartzes. Their typical mass response is 1Hz/ng/sqcm. The pores have a funnel shape; hence, cascading for the measurement of aerosol mass size distributions is difficult. ESA

N88-10312# Argonne National Lab., Ill.
ELECTRON SPUTTERING IN THE ANALYTICAL ELECTRON MICROSCOPE: CALCULATIONS AND EXPERIMENTAL DATA
N. J. Zaluzec and J. F. Mansfield Mar. 1987 15 p Presented at the Workshop on Intermediate Voltage Microscopy and Its Application To Materials Science, Ottawa, Ontario, 26 May 1987
(Contract W-31-109-eng-38)
(DE87-011457; CONF-8705165-1) Avail: NTIS HC A03/MF A01

Electron microscope imaging experiments tend to employ electron current densities ranging from approx. 0.1 to 1 A/sq cm while during microanalysis conditions probe current densities can range from 10 to values as high as 10 to the 5th A/sq cm. At 100 kV this corresponds to power densities from 100 Kilowatts/sq cm to 10 to the 4th Megawatts/sq cm. These energy deposition rates can result in electron irradiation damage which can substantially alter the structure and composition of a specimen through either ionization damage in organics or by displacement damage in inorganics and/or combinations thereof. For the most part materials scientists operating an analytical electron microscope (AEM) in the 100 to 200 kV regime studying metallic and/or ceramic specimens have been spared the need to consider either of these effects as their specimens have tended to be sufficiently resilient. However, the advent of the new medium voltage microscopes operating in the 300 to 400 kV range with high brightness guns and clean or ultrahigh vacuum systems has necessitated a re-evaluation of the effects of higher voltage operation in light of the destructive nature of the electron beam under microanalysis conditions. DOE

N88-10313# Sandia National Labs., Albuquerque, N. Mex.
RECORDING MULTIPLE SIGNALS ON A SINGLE WAVEFORM RECORDER
W. B. Boyer, F. A. Bouchier, and C. R. Mattson 1987 16 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011632; SAND-87-0257C; CONF-870656-30) Avail: NTIS HC A03/MF A01

The data acquisition system for the PBFA II accelerator is recording up to 3 signals on each of 64 LeCroy 6880 waveform recorders by separating the signals in time. The time separation is done using both the natural delay times in the accelerator and delay cables. Fast switches must be used to gate the signals to the recorder only during the time of interest. Phillips Scientific model 744 Quad Linear Gated Fan-in/Fan-out NIM modules are being used to switch the signals. Several problems with these switches had to be solved. The switches have a dc thermal drift and a nonlinear transfer function. This requires using a programmable function generator to measure and correct for the switch/6880 amplitude transfer function. The switches have a .1 output impedance. This produces spurious signals on recorded waveforms due to reflections from small deviations from 50 at the 6880 input. This problem was solved using a 5X attenuator at the switch output. Phillips has recently introduced a new model 7145 switch which should solve some of the problems encountered with the 744. DOE

N88-10314# New Hampshire Univ., Durham.
A LAYERED SCINTILLATION DETECTOR FOR SOLAR NEUTRON OBSERVATIONS
P. P. Dunphy, E. L. Chupp, M. Popecki, H. Spinka, T. Shima, D. Lopiano, and G. Glass 1986 5 p Presented at the 20th International Cosmic Ray Conference, Moscow, USSR, 2 Aug. 1986 Prepared in cooperation with Argonne National Lab., Ill. and Texas A and M Univ., College Station
(Contract W-31-109-eng-38)
(DE87-011354; ANL-HEP-CP-87-47; CONF-8608186-1) Avail: NTIS HC A02/MF A01

A detector technique suitable for measurement of high-energy (10 to 1000) MeV solar neutrons and gamma rays is discussed. A prototype instrument has been constructed for testing, using three layers of NaI with a total thickness of 30 cm, a Cerenkov detector, and charged particle shields. The response of this prototype to neutrons in the range (38 to 720) MeV has been measured, using a neutron beam at the Los Alamos Meson Physics Facility. Some results of these measurements are presented. DOE

N88-10315# Sandia National Labs., Albuquerque, N. Mex.
FABRICATION OF STANDARDIZED PIEZOELECTRIC POLYMER SHOCK GAUGES BY THE BAUER METHOD
D. J. Fogelson, L. M. Lee, D. W. Gilbert, W. R. Conley, R. A. Graham, R. P. Reed, and F. Bauer 1987 4 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987 Prepared in cooperation with Ktech Corp., Albuquerque, N. Mex., Institut Franco-Allemand de Recherches, Saint-Louis, France
(Contract DE-AC04-76DP-00789)
(DE87-012738; SAND-87-0931C; CONF-870753-29) Avail: NTIS HC A02/MF A01

A cooperative program has been initiated among our laboratories to provide a reproducible PVF sub 2 polymer film for use as a gauge under shock-compression loading. The material source and electrical treatment are based on prior work of Bauer. The primary effort of the program focused on developing electroding and poling capabilities in the US. The Bauer electrical poling method is the only known process which provides the necessary reproducibility for shock applications. It is now possible to produce gauges of excellent quality in the US. DOE

N88-10316*# Information and Control Systems, Inc., Hampton, Va.
DEVELOPMENT OF RESPONSE MODELS FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE) SENSORS. PART 2: ANALYSIS OF THE ERBE INTEGRATING SPHERE GROUND CALIBRATION Final Report
Nesim Halyo and Deborah B. Taylor 20 Mar. 1987 52 p
(Contract NAS1-16130)
(NASA-CR-178293; NAS 1.26:178293; FR-687104) Avail: NTIS HC A04/MF A01 CSCL 14B

An explicit solution of the spectral radiance leaving an arbitrary point on the wall of a spherical cavity with diffuse reflectivity is obtained. The solution is applicable to spheres with an arbitrary number of openings of any size and shape, an arbitrary number of light sources with possible non-diffuse characteristics, a non-uniform sphere wall temperature distribution, non-uniform and non-diffuse sphere wall emissivity and non-uniform but diffuse sphere wall spectral reflectivity. A general measurement equation describing the output of a sensor with a given field of view, angular and spectral response measuring the sphere output is obtained. The results are applied to the Earth Radiation Budget Experiment (ERBE) integrating sphere. The sphere wall radiance uniformity, loading effects and non-uniform wall temperature effects are investigated. It is shown that using appropriate interpretation and processing, a high-accuracy short-wave calibration of the ERBE sensors can be achieved. Author

N88-10317*# Information and Control Systems, Inc., Hampton, Va.
DEVELOPMENT OF RESPONSE MODELS FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE) SENSORS. PART 4: PRELIMINARY NONSCANNER MODELS AND COUNT CONVERSION ALGORITHMS Final Report
Nesim Halyo and Sang H. Choi 20 Mar. 1987 58 p
(Contract NAS1-16130)
(NASA-CR-178295; NAS 1.26:178295; FR-687106) Avail: NTIS HC A04/MF A01 CSCL 14B

Two count conversion algorithms and the associated dynamic sensor model for the M/WFOV nonscanner radiometers are defined. The sensor model provides and updates the constants necessary for the conversion algorithms, though the frequency with which these updates were needed was uncertain. This analysis therefore develops mathematical models for the conversion of irradiance at the sensor field of view (FOV) limiter into data counts, derives from this model two algorithms for the conversion of data counts to irradiance at the sensor FOV aperture and develops measurement models which account for a specific target source together with a sensor. The resulting algorithms are of the gain/offset and Kalman filter types. The gain/offset algorithm was chosen since it provided sufficient accuracy using simpler computations. Author

N88-10318# Stockholm Univ. (Sweden). Inst. of Physics.
DETECTIVE QUANTUM EFFICIENCY AND DESIGN OF A PARALLEL DATA RECORDING SYSTEM FOR EXELFS-MEASUREMENTS
H. Haakansson, S. Csillag, and Z. Xu May 1987 23 p
(USIP-87-06; ETN-87-90835) Avail: NTIS HC A03/MF A01

It is shown that detective quantum efficiency can be expressed as a function of the modulation transfer function of a system. A photoelectronic imaging device is described. The procedure from the incoming light quantas, through the demands on the electronic components, to collection and storing of data are outlined. ESA

N88-10319# Aeronautical Research Inst. of Sweden, Stockholm. Technical Dept.
NOTES ON TRANSDUCER DESIGN BASED ON RESISTANCE STRAIN GAGES WITH APPLIED TEMPERATURE COMPENSATION
G. I. Johnson Mar. 1986 16 p
(FFA-MEMO-129; ETN-87-90071) Avail: NTIS HC A03/MF A01

Problems in the design of transducers, particularly the influence of temperature on transducer performance, are reviewed. Temperature compensation methods for ordinary foil gages and for semiconductor gages are described. ESA

N88-10320# Technische Univ., Berlin (West Germany). Fachbereich Physikalische Ingenieurwissenschaft.
CONTRIBUTION TO THE DYNAMICAL ANALYSIS OF RHEOLINEAR NONCONSERVATIVE, GYROSCOPIC SYSTEMS USING FINITE ELEMENT METHODS Ph.D. Thesis [BEITRAG ZUR DYNAMISCHEN ANALYSE RHEOLINEARER, NICHTKONSERVATIVER, GYROSKOPISCHER SYSTEME MIT FE-METHODEN]
Georg Roth 1986 84 p In GERMAN
(ETN-87-90410) Avail: NTIS HC A05/MF A01

The vibration and stability behavior of mechanical systems, subject to nonconservative as well as gyroscopic forces, was investigated. The differential equation of motion of a beam on two supports was deduced; the analogy with pipes containing flowing fluids was explained; and an approximative solution was obtained using the finite element method. An element matrix was deduced for the gyroscopic term, and hence a matrix formulation of the problem. The resulting matrix equation was transformed into a second order differential equation, enabling a calculation of the eigenvalues. The equation of state was treated by a modal analysis, which substantially reduces the required computer time. The effect of gyroscopic forces on the eigenvalue distribution and the transfer behavior is explained. ESA

N88-10321*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
MONOCRYSTALLINE SILICON GRADIOMETER FOR GRAVITY EXPERIMENTS IN SPACE Progress Report, 1 Jan. - 13 Nov. 1987
Jean-Paul Richard 15 Nov. 1987 16 p
(Grant NAGw-1003)
(NASA-CR-181452; NAS 1.26:181452) Avail: NTIS HC A03/MF A01 CSCL 14B

A very important research effort has been made in the last decade in the field of high precision measurement with laser instrumentation. The development of a space borne gradiometer operating at a high sensitivity level using laser measurement of the distance between proof mass over a short base line of order one meter is discussed. Two aspects of laser technology make it a promising tool for gradiometry measurements: quantum limited accuracy and absolute distance measurements. The quantum limit associated with laser instrumentation was formulated. The relevant quantum and classical sources of errors in laser measurements were reviewed and corresponding laser performance requirements for gradient measurements were evaluated. Some mechanical quality factor measurements were made on simple resonant monocrystalline silicon suspensions. It was discovered that the use of zero derivative restoring forces to position the gradiometer test masses will dramatically reduce the gradiometer temperature control requirements. A laser beam side injection scheme was discovered which permits rejection of common mode accelerations. These concepts are briefly discussed. Author

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N88-10322# Ballistic Research Labs., Aberdeen Proving Ground, Md.
KR+ LASER EXCITATION OF NH2 IN ATMOSPHERIC PRESSURE FLAMES Final Report, Jan. 1984 - Oct. 1985
William R. Anderson, John A. Vanderhoff, Anthony J. Kotlar, and Koon N. Wong 13 Apr. 1987 38 p
(AD-A183421; BRL-TR-2805) Avail: NTIS HC A03/MF A01 CSCL 07B

Fluorescence in the A-X system of the NH2 radical has been excited in NH3/N2O/N2, H2/N2O/N2 and CH4/N2O/N2 flames using the 6471A line of a krypton ion laser. Trace species in the H2/N2O/N2 flame are of interest because reactions which take place in this flame are expected to be a subset of the gas phase reactions in the combustion of propellants. Detection of NH2

fluorescence was found to be very simple to implement using the krypton laser. Rotationally resolved fluorescence spectra indicate that the laser simultaneously pumps two rotational lines in the (0,11,0) to (0,2,0) vibrational hot band of the radical. The placement of the laser line relative to the two molecular transitions has been inferred from intensities in the fluorescence spectrum. Rotational and vibrational energy transfer in the excited state were observed to be very slow in comparison to electronic quenching by the flame molecules. An NH2 density profile in a rich H2/N2O/N2 flame is given. Also, a method for the calculation of Einstein coefficients and oscillator strengths for nonperturbed, main-branch transitions is presented. GRA

N88-10323# Minnesota Mining and Mfg. Co., St. Paul. Electronic and Information Sector Lab.
BLUE-GREEN LASER DIODE RESEARCH PROGRAM Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1987
J. E. Potts, H. A. Mar, and C. T. Walker Jul. 1987 72 p
(Contract N00014-85-C-0552)
(AD-A183517; QTPR-5) Avail: NTIS HC A04/MF A01 CSCL 09C

The ZnSe materials work was devoted almost exclusively to various attempts at p doping, and some of the results are quite encouraging. The laboratories have tried both Na- and Li doping and have completed work on Sb-doping, including some laser assisted incorporation of Sb. Using a clean source of Na, the laboratories were able to incorporate larger concentrations of Na without a concomitant increase in unintentionally-incorporated extrinsic donors, as was the case when the Na2Se compound source was used. Na appears to be well-behaved in the sense that the incorporated-Na concentration increases in direct proportion to the incident Na flux. However, the films remain n-type, albeit of high resistivity, even at the highest Na concentrations. In addition, the photoluminescence (PL) in high-Na-concentrations films show large broad emission near 2.60 eV, implying the presence of structural defects, perhaps induced by the Na atoms themselves. Exploring the intrinsic properties of Na as an acceptor dopant in ZnSe was studied for the first time. Previous attempts were flawed by the simultaneous incorporation of unintentially incorporated donors. GRA

N88-10324# Stanford Univ., Calif. High Energy Physics Lab.
VISIBLE FREE ELECTRON LASER OSCILLATOR Final Report
J. A. Edighoffer, G. R. Neil, S. W. Fornaca, H. Thompson, and T. I. Smith Jun. 1987 50 p
(Contract N00014-85-C-0443)
(AD-A183871) Avail: NTIS HC A03/MF A01 CSCL 09C

The first visible linac free-electron-laser (FEL) oscillator has been operated above threshold at the wavelength of 526 nm with and without a taper. Peak output power of 170 kW with a macropulse average power of 1.1 watts was observed. The cavity dielectric mirrors were damaged at approximately 140 kW sq cm of average power in the presents of UV from the FEL harmonics. The gain and efficiency were much less than predicted due to developed wiggler field errors. GRA

N88-10325# Los Alamos National Lab., N. Mex.
ELECTRON BEAM REQUIREMENTS FOR SOFT X-RAY/XUV FREE-ELECTRON LASERS
J. C. Goldstein 1987 18 p Presented at the Workshop on Low Emittance Beams, Upton, N.Y., 1 Mar. 1987
(Contract W-7405-eng-36)
(DE87-011750; LA-UR-87-2118; CONF-8703149-1) Avail: NTIS HC A03/MF A01

A discussion of the electron beam quality (peak current, energy spread, and transverse emittance) required to drive short-wavelength free-electron lasers in the XUV (10 to 100 nm) and soft X-ray (less than 10 nm) optical wavelength ranges is presented. DOE

N88-10326# Lawrence Livermore National Lab., Calif.
THERMO-OPTICAL MODELING OF FLASHLAMP-PUMPED ZIG-ZAG SLABS
R. J. Gelinas, S. K. Doss, and S. S. Murty 1 Dec. 1986 5 p Presented at the OSA/APS International Laser Science Conference, Seattle, Wash., 20 Oct. 1986
(Contract W-7405-eng-48)
(DE87-011878; UCRL-94675; CONF-861038-10) Avail: NTIS HC A02/MF A01

This article describes the thermo-optical mechanics of wave front phase distortions in flashlamp-pumped, convectively cooled zig-zag slabs. Identified are both computations and laboratory measurements, the causes of beam phase distortions that are frequently observed in output beams from zig-zag slabs. DOE

N88-10327# State Univ. of New York, Stony Brook. Research Foundation.
PICOSECOND CO2 LASER INTERACTIONS WITH POLYATOMIC MOLECULES Progress Report
1987 6 p
(Contract DE-FG02-85ER-13405)
(DE87-012072; DOE/ER-13405/T1) Avail: NTIS HC A02/MF A01

During the past year, the infrared absorption spectra of molecules in the highly vibrationally excited states were obtained using the picosecond CO2 laser system. The spectra were found to depend on the degree of excitation and the probe pulse duration. The intramolecular energy relaxation time can be inferred from this pulse duration dependence effect. This is the only study of this kind ever performed that yields dynamical results from a static spectral measurement with a variable interaction time. A Bloch equation model was used to explain the change in the absorption cross section as a function of the pulse duration at line center. The intensity dependence of the multiphoton excitation process can be explained completely by this calculation. Some initial results were also obtained on the UV-IR double resonance experiment. Using CrO2Cl2 as the sample, the time resolution of the non-resonant multiphoton ionization signal were obtained. Preliminary analysis shows that the signal decay was due to collisional deactivation of the initial electronic excitation. DOE

N88-10328# Lawrence Livermore National Lab., Calif.
LARGE-SCALE STIMULATED ROTATIONAL RAMAN SCATTERING EXPERIMENTS USING THE LLNL NOVA LASER
J. R. Murray 23 Oct. 1986 11 p Presented at the Workshop on Nonlinear Optical Techniques for SDI Applications, Albuquerque, N. Mex., 28 Oct. 1986
(Contract W-7405-eng-48)
(DE87-012661; UCRL-95611; CONF-8610208-2) Avail: NTIS HC A03/MF A01

The LLNL Nova laser is a ten-beam neodymium-glass laser system which can generate up to 15 kJ per beam in a few nanoseconds. Stimulated rotational Raman scattering (SRRS) in air limits the power delivered to one of the two target chambers of the laser if the beams are allowed to propagate in air over the entire distance. We have therefore conducted experiments using Nova to study the growth and properties of SRRS in air to assess its importance for Nova, future fusion lasers. Our early experimental results were published last November (Opt. Lett., 10, 565 (1985)). These show that the growth of SRRS from amplified spontaneous emission (ASE) in a high Fresnel number geometry is in agreement with predictions from calculated gains, and that the near-field distribution of the Raman-shifted radiation is a divergent beam with a fine speckle structure. DOE

N88-10329# Lawrence Livermore National Lab., Calif.
INDUCTION LINAC-DRIVEN FREE-ELECTRON LASERS: STATUS AND FUTURE PROSPECTS
D. Prosnitz 11 Jan. 1987 5 p Presented at OE/LASE '87, Los Angeles, Calif., 11 Jan. 1987
(Contract W-7405-eng-48)
(DE87-012914; UCRL-95849; CONF-870132-16) Avail: NTIS HC A02

The high repetition rate and low single-pass gain inherent in an RF-driven Free Electron Laser (FEL) dictate that the laser system be configured as an oscillator. This allows the laser's

electric field to build up over many passes around a high Q cavity. By way of contrast, the high-current capability of the Induction Linac (IL) system permits high single-pass optical gain, but the relatively low duty factor precludes oscillator operation; the pulses are neither long enough nor often enough to permit a field to accumulate in a cavity. The IL is thus configured as a MOPA (master oscillator/power amplifier) with a conventional laser serving as the MO. This report concentrates on the status of IL-driven FEL research and gives a description of several applications for the high-peak-power radiation produced by an induction linac FEL. DOE

N88-10330# Lawrence Livermore National Lab., Calif.
MODELS OF HIGH SPATIAL FREQUENCY THERMAL BLOOMING INSTABILITIES
R. J. Briggs 14 Aug. 1987 25 p
(Contract W-7405-eng-48)
(DE87 014280; UCID-21118) Avail: NTIS HC A03/MF A01

Simple models of the filamentation instability modes of a laser beam propagating through the atmosphere are developed. Modulation of the initial phase of the laser beam at the transmitter to compensate for atmospheric density irregularities is shown to lower the thresholds for instability onset. DOE

N88-10331*# Stanford Univ., Calif. Dept. of Applied Physics.
DIODE PUMPED SOLID-STATE LASER OSCILLATORS FOR SPECTROSCOPIC APPLICATIONS
R. L. Byer, S. Basu, T. Y. Fan, W. J. Kozlovsky, C. D. Nabors, A. Nilsson, and G. Huber (Hamburg Univ., West Germany) [1987] 7 p
(Grant NAG1-182)
(NASA-CR-180576; NAS 1.26:180576) Avail: NTIS HC A02/MF A01 CSCL 20E

The rapid improvement in diode laser pump sources has led to the recent progress in diode laser pumped solid state lasers. To date, electrical efficiencies of greater than 10 percent were demonstrated. As diode laser costs decrease with increased production volume, diode laser and diode laser array pumped solid state lasers will replace the traditional flashlamp pumped Nd:YAG laser sources. The use of laser diode array pumping of slab geometry lasers will allow efficient, high peak and average power solid state laser sources to be developed. Perhaps the greatest impact of diode laser pumped solid state lasers will be in spectroscopic applications of miniature, monolithic devices. Single-stripe diode-pumped operation of a continuous-wave 946 nm Nd:YAG laser with less than 10 m/w threshold was demonstrated. A slope efficiency of 16 percent near threshold was shown with a projected slope efficiency well above a threshold of 34 percent based on results under Rhodamine 6G dye-laser pumping. Nonlinear crystals for second-harmonic generation of this source were evaluated. The KNbO3 and periodically poled LiNbO3 appear to be the most promising. B.G.

N88-10332*# Stanford Univ., Calif. Labs. of Physics.
HIGH ENERGY EFFICIENT SOLID STATE LASER SOURCES Semiannual Progress Report, period ending 30 Sep. 1987
Robert L. Byer 3 Nov. 1987 8 p
(Grant NAG1-182)
(NASA-CR-181362; NAS 1.26:181362) Avail: NTIS HC A02/MF A01 CSCL 20E

Investigations continue of diode-laser-pumped solid-state laser oscillators and nonlinear processes using them as sources. Diode laser array pumped Nd:YAG and Nd:glass lasers have been demonstrated. Theoretical studies of non-planar oscillators have been advanced, producing new designs which should be more resistant to feedback and offer better frequency stability. A monolithic, singly resonant Optical Parametric Oscillator in MgO:LiNbO3 has been operated. Author

N88-10333# Technische Univ., Berlin (West Germany). Fachbereich Physik.
SEGMENTED HOLLOW CATHODE DISCHARGES FOR COPPER ION LASERS Ph.D. Thesis [SEGMENTIERTE HOHLKATHODE-NENTLADUNGEN FUER KUPFERIONENLASER]
Juergen Hamisch 1987 107 p In GERMAN
(ETN-87-90403) Avail: NTIS HC A06/MF A01

Effects deviating from the ideal behavior of copper ion lasers were studied. It is shown that segmented hollow cathodes cannot be considered as independent of each other. The effects of impurities (due to leaks) were determined. The experimentally observed effect of cathode deformation due to sputtering on the lifetime was confirmed by a model calculation. Therefore, a laser tube construction with exchangeable cathode segments was designed. Another lifetime-limiting effect, the breakdown of cathode segments by unwanted arc discharges, was drastically reduced by an active current control. The lifetime of the mirrors was improved by a factor 50 using a laser arrangement in ultra high vacuum. As an application of segmented hollow cathode discharges, an amplification determination following the resonator method in the VUV was developed. ESA

N88-10334# Technische Hochschule, Karlsruhe (West Germany). Fakultaet fuer Elektrotechnik.
INVESTIGATION OF LIDAR BACKSCATTER INCLUDING DEPOLARIZATION AND HIGHER SCATTERING ORDERS Ph.D. Thesis [UNTERSUCHUNG DER LIDAR-RUECKSTREUUNG EINSCHLIESSLICH DEPOLARISATION UND HOEHERER STREUORDNUNGEN]
Ubbo Ricklefs 1985 166 p In GERMAN Sponsored by Deutschen Forschungsgemeinschaft, West Germany
(ETN-87-90431) Avail: NTIS HC A08/MF A01

A lidar signal model of the depolarization of the backscatter signal, which takes into account direct backscatter as well as other scattering phenomena of aerosol particles, was developed. Special attention was paid to pulse times. An inversion method for the determination of the particle densities from the model parameters is presented. In order to verify the model, tests were performed with a monostatic single-wavelength lidar system. The analysis of the signals shows different effective extinction coefficients, the interpretation of which requires higher scattering orders. It is shown that the approximation of aspherical particles by homogeneous spherical particles is not possible for the description of the lidar backscatter signal. The measurements are found to be in excellent agreement with the theoretical signal parameters for scattering on homogeneous spherical droplets in clouds. ESA

N88-10335# Technische Hochschule, Darmstadt (West Germany). Fachbereich Physik.
GEOMETRY AND REPRODUCIBILITY OF A PLASMA-SUPPORTED REMOVAL OF MATERIAL BY LASER RADIATION Ph.D. Thesis [GEOMETRIE UND REPRODUZIERBARKEIT EINER PLASMAUNTERSTUETZTEN MATERIALABTRAGUNG DURCH LASERSTRAHLUNG]
Hans-Georg Treusch 1985 146 p In GERMAN
(ETN-87-90436) Avail: NTIS HC A07/MF A01

The effects of the different parameters of the process of material removal by laser radiation on the result of the treatment were investigated. The starting phase of the material treatment is determined by the heating of the target. The interaction between laser radiation and target is determined by the laser-induced plasma, the effect of which on the treatment is discussed. The treatment can be optimized by an adaptation of the laser intensity. The process parameters which determine the geometry of the removal of material, the removal efficiency, and the reproducibility of the geometry are discussed. ESA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N88-10336 British Petroleum Co. Ltd., London (England).
TAPE WRAPPING APPARATUS AND METHOD Patent Application
Rayner Michael Mayer, inventor 21 May 1986 11 p Filed 31 Oct. 1985 Priority 3 Nov. 1984 GB 8427876
(EP-Patent-0-181-747-A2; EP-Patent-Appl-SN-85307921.8; Int-Patent-Class-B65H-81/00; ETN-87-98634) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

An apparatus for wrapping a body with a length of tape is presented. It comprises a feeding means, including a tape guide; and means for rotating the body about a first axis, the feeding means and the body being relatively moveable between a first position in which rotation of the body about the first axis causes the tape to be wrapped across the body in a first direction and a second position in which the tape is wrapped across the body in the reverse direction. Means for rotating the body about a second axis to thereby effect the movement between first and second positions is included. A method of tape wrapping is described. ESA

N88-10337 British Petroleum Co. Ltd., London (England).
ADDITION POLYIMIDE COMPOSITION Patent Application
Frank Charles Robertson, inventor 8 Jan. 1986 20 p Filed 6 Jun. 1985 Priority 7 Jun. 1984 GB 8414594
(EP-Patent-0-167-304-A1; EP-Patent-Appl-SN-85304041.8; Int-Patent-Class-C08G-73/12; Int-Patent-Class-C08L-79/08; Int-Patent-Class-C08L-63/10; ETN-87-98640) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A curable thermosetting polyimide composition comprising a major proportion of a polyimide prepolymer and a minor proportion of a vinyl ester is presented. The polyimide prepolymer may be N,N'-bis-imide having a divalent radical containing at least one carbon atom, and a divalent radical containing a carbon-carbon double bond. The composition is suitable for use as a matrix material for fiber reinforced plastic compositions, and may be used to prepare prepreg materials. ESA

N88-10338 British Petroleum Co. Ltd., London (England).
STEERING MECHANISM Patent Application
John Kimberly Wells, inventor 21 May 1986 12 p Filed 10 Oct. 1985 Priority 17 Oct. 1984 GB 8426278
(EP-Patent-0-181-700-A1; EP-Patent-Appl-SN-85307273.4; Int-Patent-Class-B62D-1/18; ETN-87-98641) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A collapsible steering mechanism for a vehicle, comprising a steering shaft having a steering means connected to its upper end and a steering gear connected to its lower end is presented. The steering shaft comprises an elongated energy absorbing tube having a bond between the tube and one or both of the steering gear and the steering means. The longitudinal axial component of the bond is adapted to disrupt under crash impact and to allow the tube to progressively collapse and absorb the impact energy. ESA

N88-10339*# General Electric Co., Lynn, Mass. Aircraft Engine Business Group.
THE DESIGN OF A TURBOSHAFT SPEED GOVERNOR USING MODERN CONTROL TECHNIQUES Final Report, 30 Sep. 1982 - 20 Feb. 1985
G. delosReyes and D. R. Gouchoe Feb. 1986 220 p
(Contract NAS3-22763)
(NASA-CR-175046; NAS 1.26:175046) Avail: NTIS HC A10/MF A01 CSCL 13I

The objectives of this program were: to verify the model of off schedule compressor variable geometry in the T700 turboshaft engine nonlinear model; to evaluate the use of the pseudo-random binary noise (PRBN) technique for obtaining engine frequency response data; and to design a high performance power turbine speed governor using modern control methods. Reduction of T700 engine test data generated at NASA-Lewis indicated that the off schedule variable geometry effects were accurate as modeled. Analysis also showed that the PRBN technique combined with the maximum likelihood model identification method produced a Bode frequency response that was as accurate as the response obtained from standard sinewave testing methods. The frequency response verified the accuracy of linear models consisting of engine partial derivatives and used for design. A power turbine governor was designed using the Linear Quadratic Regulator (LQR) method of full state feedback control. A Kalman filter observer was used to estimate helicopter main rotor blade velocity. Compared to the baseline T700 power turbine speed governor, the LQR governor reduced droop up to 25 percent for a 490 shaft horsepower transient in 0.1 sec simulating a wind gust, and up to 85 percent for a 700 shaft horsepower transient in 0.5 sec simulating a large collective pitch angle transient. Author

N88-10340*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
ASSESSMENT OF THE COFSI/MAST I PROJECT Final Report, period ended 15 Sep. 1987
Meng-Sang Chew Sep. 1987 16 p
(Contract NAS1-17993)
(NASA-CR-181366; NAS 1.26:181366; TA-75) Avail: NTIS HC A03/MF A01 CSCL 13I

The COFS (MAST I) deployer/retractor assembly (DRA) which has a cluster of mechanisms that constitute the collapsible-extensible Mast, contains mechanisms/linkages that deploy and retract. The Mast is a flexible spatial (3D) linkage with hinges that lock into place during deployment to form a truss type structure. It is 60 meters long with repeating sections of two bays. Each bay has alternating diagonals. All joints are single degree-of-freedom hinges, arranged such that the Mast does not rotate during deployment/restow and that deformation energy is minimized. Mispan hinges are incorporated in the diagonals and half of the batten members. The various operational aspects and characteristics of the various mechanisms within the DRA are analyzed. In view of the disadvantages of statical in determinancy as well as the inefficiencies inherent in recirculating gear trains, it is recommended that the bevel gear trains and the bell-crank mechanisms be redesigned. Author

N88-10341# MATRA Espace, Paris-Velizy (France). Space Branch.
ROBOTIC SENSORS AND ACTUATORS FOR A SERVICE MANIPULATOR SYSTEM. VOLUME 1: EXECUTIVE SUMMARY Final Report
Th. Blais, J. L. Lacombe, G. Berger, G. Clement, U. Hilzenbecher, and J. DelToro (Sener, S.A., Madrid, Spain) Paris, France ESA Jun. 1986 62 p Original contains color illustrations
(Contract ESA-5739/83-NL-AN(SC))
(Matra-EPT/DT/VT187/120; ESA-CR(P)-2403-Vol-1; ETN-87-90536) Copyright Avail: NTIS HC A04/MF A01

The state of the art of robotics, telemanipulation, and servicing was reviewed in order to develop a service manipulator system (SMS) for in-orbit servicing. An SMS concept is described. Development activities and test requirements in vision systems, control techniques, end effector grapple mechanisms, force/torque sensors, and hinge joints are outlined. A development plan is presented. ESA

N88-10342# MATRA Espace, Paris-Velizy (France). Space Branch.
ROBOTIC SENSORS AND ACTUATORS FOR A SERVICE MANIPULATOR SYSTEM. VOLUME 2: SERVICE MANIPULATOR SYSTEM (SMS) HANDBOOK Final Report
Th. Blais, J. L. Lacombe, G. Berger, G. Clement, U. Hilzenbecher, and J. DelToro (Sener, S.A., Madrid, Spain) Paris, France ESA Jun. 1986 113 p
(Contract ESA-5739/83-NL-AN(SC))

(Matra-EPT/DT/VT187/227; ESA-CR(P)-2403-Vol-2; ETN-87-90537) Copyright Avail: NTIS HC A06/MF A01

A service manipulator system (SMS) for in-orbit servicing is described. The mechanical characteristics, electrical architecture, sensors, control system, software, thermal control, mass/power/communication budgets, and SMS mass distribution, reference frames, and flight segment are presented. The SMS specifications, quality assurance provisions, and preparation for delivery are outlined. ESA

N88-10343# MATRA Espace, Paris-Velizy (France). Space Branch.

ROBOTIC SENSORS AND ACTUATORS FOR A SERVICE MANIPULATOR SYSTEM. VOLUME 3, PHASE A REPORT AND PROGRAM PLAN Final Report

Th. Blais, J. L. Lacombe, G. Berger, G. Clement, U. Hilzenbecher, and J. DelToro (Sener, S.A., Madrid, Spain) Paris, France ESA Jun. 1986 233 p

(Contract ESA-5739/83-NL-AN(SC))

(Matra-EPT/DT/VT187/228; ESA-CR(P)-2403-Vol-3; ETN-87-90538) Copyright Avail: NTIS HC A11/MF A01

The state of the art of robotics, telemanipulation, and servicing was reviewed in order to develop a service manipulator system (SMS) for in-orbit servicing. An SMS concept is described. Development activities and test requirements in vision systems, control techniques, end effector grapple mechanisms, force/torque sensors, and hinge joints are outlined. A development plan is presented. ESA

N88-10344# International Research and Development Co. Ltd., Newcastle (England).

COMPOSITE BEARING MATERIALS CONTAINING SOLID LUBRICANT IN FILAMENTARY FORM, STAGES 3 AND 4

H. P. Bailey Jan. 1987 40 p

(Contract MOD-A91A/1205)

(IRD-87/2; BR101572; ETN-87-90682) Avail: NTIS HC A03/MF A01

The development of test bearings based on lubricant cored wire is described. Wires using copper matrixes with 1, 3, and 7 graphite cores were produced. Test pieces were produced by compacting and alloying short pieces of wire which exhibited wear properties an order of magnitude better than commercial material. Attempts to produce wire bearings with enhanced lubricity using molybdenum disulfide cored wire caused practical difficulties. ESA

N88-10345# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

VARIATIONAL AND NONVARIATIONAL THEORY OF FRICTIONLESS ADHESIVE CONTACT BETWEEN BODIES

J. J. Kalker 1987 22 p

(Rept-87-11; B8711344; ISSN-0920-8577; ETN-87-90844) Copyright Avail: NTIS HC A03/MF A01

Two versions of the principle of minimum potential energy for the frictionless adhesive contact between a smooth surfaced elastic and a smooth surfaced rigid body are set up. The nonvariational first order equalities equivalent to the variational principles are given, as well as a condition for stability. They show that in the case of isotropy the intensity of the inverse square root singularity of the surface traction at the edge of contact is a constant composed of the material constants of the bodies. This property appears to be a powerful tool in solving special problems, notably in the case of the Hertz problem where it is shown that except in the axisymmetric case the contact area is not elliptic. ESA

N88-10346# Oak Ridge National Lab., Tenn.

TRACTION-DRIVE SEVEN DEGREES-OF-FREEDOM TELE-ROBOT ARM: A CONCEPT FOR MANIPULATION IN SPACE

D. P. Kuban and D. M. Williams 1987 21 p Presented at the 21st Aerospace Mechanisms Symposium, Houston, Tex., 29 Apr. 1987

(Contract DE-AC05-84OR-21400)

(DE87-010895; CONF-8704161-1) Avail: NTIS HC A03/MF A01

As man seeks to expand his dominion into new environments, the demand increases for machines that perform useful functions in remote locations. This new concept for manipulation in space is based on knowledge and experience gained from manipulator systems developed to meet the needs of remote nuclear applications. It merges the best characteristics of teleoperation and robotic technologies. This paper summarizes the report of a study performed for NASA Langley Research Center. The design goals for the telerobot, a mechanical description, and technology areas that must be addressed for successful implementation will be presented and discussed. The concept incorporates mechanical traction drives, redundant kinematics, and modular arm subelements to provide a backlash-free manipulator capable of obstacle avoidance. Further development of this arm is in progress at the Oak Ridge National Laboratory. DOE

N88-10347# Lawrence Livermore National Lab., Calif.

EXPERIMENTAL MEASUREMENTS AND NUMERICAL SIMULATIONS OF METAL SPALLATION BY DETONATING SOLID EXPLOSIVES

C. M. Tarver and D. E. Maiden 14 Jul. 1987 5 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987

(Contract W-7405-eng-48)

(DE87-013227; UCRL-96496; CONF-870753-58) Avail: NTIS HC A02

Fabry-Perot laser interferometric measurements of the free surface velocities of tantalum and copper plates spalled by the detonating solid explosives LX-14, LX-17 and RX-26-AF are reported. Numerical calculations using the ignition and growth reactive flow model for the detonating explosive, the Steinberg-Guinan high strain rate constitutive model for the metal, and two different spall models are shown to accurately simulate the experimental records. DOE

N88-10348# Pacific Northwest Labs., Richland, Wash.

HEAT ENGINE REGENERATORS: RESEARCH STATUS AND NEEDS

R. A. Hutchinson Aug. 1987 67 p

(Contract DE-AC06-76RL-01830)

(DE87-013581; PNL-6278) Avail: NTIS HC A04/MF A01

The rapidly oscillating, variable density flows of regenerative heat engines provide a class of poorly understood unsteady flow and heat transfer problems. These problems are not currently amenable to direct experimental resolution. Experiences in engine development and test programs and efforts to develop analysis tools point to the regenerator as a key area of insufficient understanding. Focusing on flow and heat transfer in regenerators, this report discusses similarity parameters for the flows and reviews the experimental data currently available for Stirling analysis. Then a number of experimental results are presented from recent fundamental fluid mechanical and thermal investigations that shed additional light on the functioning of heat engine regenerators. Suggestions are made for approaches for further measurement and analysis efforts. DOE

N88-10349# Japan Atomic Energy Research Inst., Tokyo.

EXACT SOLUTION OF THE INVERSE PROBLEM FOR A SIX-LINK MANIPULATOR WITH A MECHANICAL OFFSET

S. Sasaki and K. Nabeshima Dec. 1986 70 p

(DE87-702646; JAERI-M-86-180) Avail: NTIS (US Sales Only) HC A04/MF A01

In this paper, an algebraic approach to derive a joint solution for a six-link manipulator with a mechanical offset is proposed. Generally, derivation of exact joint solutions for such a multi-link manipulator is considered to be an extremely cumbersome problem and a practical approach might be limited to numerical approximation based on linearization and iteration. Compared with such a conventional method, the polynomial expression presented in this paper permits to determine all feasible solutions of the

inverse kinematics of the manipulator. An algorithm of the solution for a six-link manipulator was implemented in the computer code ARM3. Joint behaviors with the mechanical offset were obtained with sufficient accuracies. DOE

N88-10350 Georgia Inst. of Tech., Atlanta.
AUGMENTING THE CONTROL OF A FLEXIBLE MANIPULATOR WITH PASSIVE MECHANICAL DAMPING Ph.D. Thesis
Thomas Edward Alberts 1986 148 p
Avail: Univ. Microfilms Order No. DA8707849

Achieving fast and accurate manipulation with lightweight robots requires control strategies designed to accommodate structural flexibility. Controlling flexible structures through purely active measures can be cumbersome in terms of hardware and computation time requirements. In many cases it is possible to augment active controllers using passive measures, thereby easing the burden of active control. Experimental and analytical results verify the feasibility of this scheme. Experimental results show that a practical flexible structure under active control is subject to instability due to the close proximity of the structure's poles to the imaginary axis. Adding passive damping is demonstrated experimentally. A straightforward root locus analysis substantiates this result. A modified Bernoulli-Euler Beam equation is derived that accommodates structures exhibiting linear viscoelastic behavior. The derivation is based on the standard constitutive relationship for viscoelastic materials, in place of Hooke's law. Transfer functions, for a flexible beam treated with a constrained viscoelastic layer damping treatment, are derived from the modified equation. Dissert. Abstr.

N88-10351# BDM Corp., Austin, Tex.
TECHNOLOGY SURVEY FOR A ROBOT WHICH WILL INVESTIGATE THE CONDITION OF UNDERGROUND PIPE Topical Report, Jun. - Sep. 1986
B. Firey, C. Zinsmeyer, and J. P. Coose 22 Sep. 1986 186 p
(Contract GRI-5086-271-1226)
(PB87-209979; GRI-86/0254) Avail: NTIS HC A09/MF A01 CSCL 13I

The feasibility of a robotic device to operate within underground gas distribution pipe systems and investigate the condition of the pipe is considered. The device is defined to consist of seven subsystems: locomotion, steering and articulation, power, navigation, inspection, communication and control. Existing and emerging technologies appropriate to each of the subsystems are surveyed and candidate technologies showing promise of achieving the necessary functionality, subject to the constraints, resulting from the operating environment, are identified. The robot is found to present major challenges in robotic control, miniaturized packaging, and autonomous navigation: it appears that these difficulties are surmountable with present day technology. Several technological areas are identified in which future developments should be monitored, since progress is expected which could improve the projected performance of the inspection device. GRA

N88-10352# Auburn Univ., Ala. Dept. of Mechanical Engineering.
AUTOMATIC SEAM WELDING WITH INFRARED SENSOR FEEDBACK
K. Grooms and B. A. Chin 15 Jun. 1987 35 p
(Contract DE-FG05-85NE-37949)
(DE87-013556; DOE/NE-37949/T2) Avail: NTIS HC A03/MF A01

An automatic seam tracking system has been developed which uses an infrared sensor as visual feedback. The infrared system determines torch seam error by observing changes in the thermal distribution surrounding the weld torch. This paper presents information concerning the design, implementation and testing of the system. DOE

N88-10353# Integral Technologies, Inc., Westmont, Ill.
MULTIDIMENSIONAL MODELING OF CONVECTIVE HEAT TRANSFER WITH APPLICATION TO IC ENGINES Technical Progress Report
M. J. Jennings and T. Morel 18 Jun. 1987 12 p
(Contract DE-AC04-86AL-33183)
(DE87-011046; DOE/AL-33183/T3) Avail: NTIS HC A03/MF A01

The objective of this project is to develop a more comprehensive understanding of the convective heat transfer process in complex, unsteady turbulent reacting flows, typical of those which occur in internal combustion engines. The specific area of research is the representation of heat transfer in detailed multi-dimensional Navier-Stokes models, and modeling of turbulent transport mechanisms. The detailed tasks include a review of relevant prior work. Based on this review, and original work done under this contract, several modeling approaches are formulated. The tests are carried out on flow cases which have relevance to engine flows, and for which reliable experimental data exist. The analytical studies lead to the determination of the best modeling approaches to be used for heat transfer simulation in internal combustion engines. Following that, a detailed study is carried out of spatial and temporal heat flux distribution in a representative engine. This is complemented by a parametric study of engine heat transfer dependence on intake flow details, combustion chamber geometry, engine speed and engine load. DOE

N88-10354# Massachusetts Inst. of Tech., Cambridge.
THE DEVELOPMENT OF A FRICTION MODEL PREDICTING THE SLIDING BEHAVIOR OF MATERIALS PAIRS, ESPECIALLY AT LOW TEMPERATURES: PROGRESS REPORT AND RENEWAL PROPOSAL
Yukikazu Iwasa and E. Rabinowicz Mar. 1987 16 p
(Contract DE-FG02-85ER-13335)
(DE87-013941; DOE/ER-13335/2) Avail: NTIS HC A03/MF A01

The principal objective of this renewal proposal is to develop a friction model which predicts whether a sliding system will give steady or unsteady sliding behavior at low speeds and to advance the basic understanding of the friction process. The proposed program consists of experimental and analytical studies. Experimental work will include collecting data on the material properties of the two contacting materials, namely the bulk creep behavior in tension and interfacial creep data in shear. These data will be collected both at room temperature, and at cryogenic temperatures. Interfacial creep takes place when one material is pressed against the other by a constant force and a shear force insufficient to cause gross sliding is applied. The extent to which the bulk creep properties affect the interfacial creep behavior will be determined, and this knowledge will lead to better models of the friction process. DOE

N88-10355*# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
STUDY OF FREE-PISTON STIRLING ENGINE DRIVEN LINEAR ALTERNATORS Final Report
S. A. Nasar and C. Chen 31 Jul. 1987 52 p
(Grant NAG3-722)
(NASA-CR-181425; NAS 1.26:181425) Avail: NTIS HC A04/MF A01 CSCL 13I

The analysis, design and operation of single phase, single slot tubular permanent magnet linear alternator is presented. Included is the no-load and on-load magnetic field investigation, permanent magnet's leakage field analysis, parameter identification, design guidelines and an optimal design of a permanent magnet linear alternator. For analysis of the magnetic field, a simplified magnetic circuit is utilized. The analysis accounts for saturation, leakage and armature reaction. Author

N88-10356# Southwest Research Inst., San Antonio, Tex.
ENDURANCE TESTING OF A NATURAL GAS-FUELED ROTARY ENGINE Final Report, Mar. 1985 - Jan. 1987
S. R. King Jan. 1987 98 p

(Contract GRI-5084-233-1072)
(PB87-215703; SWRI-8516; GRI-87/0050) Avail: NTIS HC A05/MF A01 CSCL 21A

Endurance testing was conducted on production automotive-type Mazda 13B rotary engines converted for operation on natural gas. Through regular scheduled teardown inspections, wear data were gathered on critical engine components and used to develop component wear trends over 6000 hours of engine operation. Wear trends were used to predict the usable life of the engine before requiring a major rebuild. The engines were operated at the steady-state conditions of 4000 rpm/52 brake horsepower. An average thermal efficiency of 26 percent was obtained at 400 rpm wide-open-throttle conditions. Results indicate apex-seal wear rates and trochoid-surface wear rates low enough to achieve 20,000 hours of engine operation. Based on wear predictions, the limiting factors for durability appear to be the main and rotor bearings and the side-seal end-gap clearance. A crankcase oil-pump failure resulted in a premature failure of the main bearings and damage to other high-load components. In spite of the failure, durability tests indicate favorable results for the use of rotary engines in prime mover applications. GRA

N88-10357# Stuttgart Univ. (West Germany). Inst. fuer Thermische Stroemungsmaschinen.
THE EFFECT OF DIFFERENT PACKAGINGS ON THE VIBRATION BEHAVIOR AND THE COUPLING FACTORS OF STEAM TURBINE BLADING Ph.D. Thesis [EINFLUSS UNTERSCHIEDLICHER PAKETIERUNGEN AUF SCHWINGUNGSVERHALTEN UND VERBUNDFAKTOREN VON DAMPFTURBINENBESCHAUFELUNGEN]
Richard Pfeiffer 1985 128 p In GERMAN
(ETN-87-90425) Avail: NTIS HC A07/MF A01

The vibration behavior of turbomachine bladings is described, and the behavior of different kinds of coupled low pressure stages was experimentally investigated. Besides purely stationary flow conditions, conditions were also considered where pulsating flow fields or periodic angular momentum variations, introduced via the turbine rotor shaft, lead to resonances. Strain gages were fixed onto the blade surfaces to determine the resonance loading. It is demonstrated how a dynamic blade loading can be influenced at constant driving forces. In normal cases, a roundabout coupling reduces the resonance amplitudes to free blades, but even then, unacceptably high loading can occur. Suitable blade packaging can reduce the loading in a simple and efficient way. ESA

N88-10358# Stuttgart Univ. (West Germany). Inst. fuer Leistungselektronik und Anlagentechnik.
CONTRIBUTIONS TO FAST-REACTING AND HIGH-PRECISION THREE-PHASE POSITIONING SYSTEMS Ph.D. Thesis [BEITRAEGE ZU REAKTIONSSCHNELLEN UND HOCHGENAUEN DREHSTROM-POSITIONERSYSTEMEN]
Bernhard Schwarz 1986 144 p In GERMAN
(ETN-87-90427) Avail: NTIS HC A07/MF A01

A high quality positioning system was realized to fulfil the partially contradicting requirements concerning positioning accuracy, positioning stability, high dynamic range, and good perturbation transmission behavior. A permanently excited synchronous machine was fed via a transistor pulsed converter. A control system for positioning drives is described; the limits and applicability of the system are discussed. A measuring data acquisition system is presented. Measurements, performed on a model setup, show very good agreement with the theoretically expected results, and demonstrate the quality of the proposed positioning system. ESA

N88-10359# Stuttgart Univ. (West Germany). Inst. fuer Luftfahrtantriebe.
A FLOW FUNCTION METHOD FOR THE AXISYMMETRIC CALCULATION OF THE TRANSONIC TURBOMACHINE FLOW TAKING INTO ACCOUNT THE FLOW DIFFERENCES IN CIRCUMFERENTIAL DIRECTION Ph.D. Thesis [EIN STROMFUNKTIONSVERFAHREN ZUR ROTATIONSSYMMETRISCHEN BERECHNUNG DER TRANSSONISCHEN TURBOMASCHINENSTROEMUNG UNTER BERUECKSICHTIGUNG DER STROEMUNGSUNTERTERSCHIEDE IN UMFANGSRICHTUNG]
Helmut Simmler 1986 109 p In GERMAN
(ETN-87-90428) Avail: NTIS HC A06/MF A01

A method for the calculation of the fundamental characteristics of the transonic flow in turbomachines for meridional Mach numbers up to one is presented. A model was developed for single and multistage machines, by iteratively solving an equation system using the flow function. The perturbation quantities, integrated in circumferential direction, were determined by a time-step method. The entropy variations in inviscid flow were implicitly determined. The flow function method and the time-step method were verified by comparison with analytically calculated flows. The method for the determination of the circumferentially averaged turbomachine flow was verified by experimental data. ESA

N88-10360# Karlsruhe Univ. (West Germany). Fakultaet fuer Maschinenbau.
THE INFLUENCE OF HIGH FREE STREAM TURBULENCE, INTENSIVE COOLING AND WAKE ON THE EXTERNAL HEAT TRANSFER OF CONVECTIVELY COOLED GAS TURBINE BLADES Ph.D. Thesis [ZUM EINFLUSS HOHER FREISTROMTURBULENZ, INTENSIVER KUEHLUNG UND EINER NACHLAUFSTROEMUNG AUF DEN AEUSSEREN WAERMEUEBERGANG EINER KONVERKTIV GEKUEHLTEN GASTURBINESCHAUFEL]
Achmed Volker Schulz 1986 168 p In GERMAN
(ETN-87-90432) Avail: NTIS HC A08/MF A01

The external heat transfer on a convectively cooled gas turbine blade in cascade configuration was investigated. The temperature profile in the blade cross section was calculated by a finite element method, using experimentally determined boundary conditions. The results show a pronounced correlation between the turbulence degree and the heat transfer on the global blade surface. Strong cooling of the blade surface causes a stabilization of the blade boundary layer. The measurements are in very good agreement with theoretically determined heat transitions for laminar and fully turbulent heat transfer; the agreement for laminar-turbulent transition is less good. The effect of the local wake turbulence structure on the heat transfer behavior along the blade surface was determined. A model calculation of a moving wake provides the quasi-stationary temperature profile. ESA

N88-10361# Gesamthochschule, Duisburg (West Germany). Fachbereich Maschinenbau.
MODEL ADAPTATION AND IMBALANCE COMPENSATION IN ROTORS WITH ACTIVE MAGNETIC BEARINGS Ph.D. Thesis [MODELLADAPTION UND UNWUCHTKOMPENSATION BEI ROTOREN IN AKTIVEN MAGNETLAGERN]
Reiner Blessing 1985 134 p In GERMAN
(ETN-87-90440) Avail: NTIS HC A07/MF A01

A rigid rotor with magnetic bearings, whose dynamic behavior changes with operational conditions, was investigated. The general adaptive control concepts were adapted to the mechanical system. The rotor parameters (mass, mass distribution) were considered unknown. Adaptation laws for a model rotor which simultaneously comprise a perturbation compensation for the suppression of unbalance vibrations were developed. A digital simulation of the rotor behavior, which takes into account limitations for technical use, is used to assess the behavior of the real rotor. A transfer of the adaptive control concepts for rigid rotors with magnetic bearing to elastic rotors and rotor systems seems possible. ESA

N88-10362# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Gitterstroemungen.
THEORETICAL INVESTIGATIONS OF THREE TURBINE CASCADES USING A TWO DIMENSIONAL TIME MARCHING PROCEDURE
Peter-Anton Giess Dec. 1986 78 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-1077)
(DFVLR-FB-87-02; ISSN-0171-1342; ETN-87-90449) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 23

Flow field calculations in the subsonic and transonic downstream velocity range were performed for a stator and two rotor cascades using a two-dimensional time marching procedure. The convergence behavior of the numerical solution was determined by the time evolution of the homogeneous flow quantities. The evaluation of the local flow quantities allowed the verification of the assumptions on which the simplified methods for the calculation of the homogoneous downstream flow angle are based. The agreement between calculated results and experimental data becomes better when the real experimental conditions are better modelled in the calculation. ESA

N88-10363# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
APPLICATION OF KALKER'S ROLLING CONTACT THEORY TO THE SIMULATION OF RAIL VEHICLES
Alfred Jaschinski Feb. 1987 61 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-07; ISSN-0171-1342; ETN-87-90454) Avail: NTIS HC A04/MF A01; DVFLR, Cologne, West Germany DM 21

A rolling contact theory and computer programs were tested on their applicability to the simulation of rail vehicles, emphasizing wheel-rail simulations. The limitations of the theory regarding the simulation of vehicle lateral dynamics are indicated. ESA

N88-10364# Stuttgart Univ. (West Germany). Inst. fuer Thermische Stroemungsmaschinen.
CALCULATION OF STATIONARY AND LOW FREQUENCY UNSTEADY FLOWS IN A STEAM TURBINE END STAGE [BERECHNUNG STATIONAERER UND NIEDERFREQUENT INSTATIONAERER STROEMUNGEN IN EINER DAMPFTURBINEN-ENDSTUFE]
Ruprecht Lattermann 1986 130 p In GERMAN
(Mitt-23; ETN-87-90559) Avail: NTIS HC A07/MF A01

A numerical method for the calculation of unsteady, inviscid turbomachine flow in the transonic velocity range is described. The calculation of complete stages is possible. If the flow layer geometry is given, the flow field can be determined by independent calculations on several radial cross sections. The physical integration domain, together with the differential equation system, is transformed in an equidistant-orthogonal, rectangular grid, where it is solved by finite differences. A correction, following the theory of characteristics and compatible with the finite difference method, is applied at all boundaries. The calculation of test cases from the literature shows good agreement with exact solutions and measurements. ESA

N88-10365 Royal Signals and Radar Establishment, Malvern (England).
IMPROVEMENTS TO THE PRECISION PAN AND TILT HEAD
J. D. Roberts, E. C. E. Charlwood, P. N. Griffith, and F. Mansfield Dec. 1986 17 p
(RSRE-MEMO-3996; BR102843; ETN-87-90979) Copyright Avail: NTIS HC A03/MF A01

Drive and control improvements made to a heavy duty precision pan and tilt head are described. The drive improvements result in an increased maximum performance for the head to 4R/s sq, in acceleration and to 0.85 R/sec in velocity. The improvements to the control circuitry allow adaption to computer control. Two approaches which represent two levels of complexity in the control algorithms are outlined. ESA

N88-10090*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TELEROBOTICS
Donna L. Pivirotto *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 71-75 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N88-10366# Stuttgart Univ. (West Germany). Staatliche Materialpruefungsanstalt.
EVALUATION OF MECHANICAL AND TECHNOLOGICAL PARAMETERS OF DIFFERENT STEEL STATES BY NONDESTRUCTIVE MICRO- AND MACROMAGNETIC MEASURING QUANTITIES AS WELL AS ULTRASONIC TECHNIQUES Final Report
P. Deimel, W. Burr, D. Kuppler, and E. Sattler Dec. 1985 158 p In GERMAN
(Contract BMFT-1500-656-3)
(MPA-810-079; ETN-87-90362) Avail: NTIS HC A08/MF A01

The evaluation of material states with respect to their mechanical-technological characteristics using nondestructive micro and macromagnetic as well as ultrasonic measuring was studied. Theoretical fundamentals, such as the relations between yield strength and microstructure, and microstructural models for ductile fracture, are discussed. Models for the calculation of the yield strength and the critical value of the J integral are discussed. The experimental setup is described. The experimental results show good agreement with calculated values for the yield strength as well as for the J integral. ESA

N88-10367# Fraunhofer-Inst. fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (West Germany). Inst. fuer Zerstoerungsfreie Pruefverfahren.
NONDESTRUCTIVE INSPECTION OF THE PRESSURE VESSEL IN STUTTGART. ALOK PART. PHASE 1: ALOK COMBINED WITH CONVENTIONAL PROBES
W. Kappes, O. A. Barbian, H. Paul, and R. Licht 14 Mar. 1986 78 p In GERMAN; ENGLISH summary
(Contract BMFT-GRS-1500-7060)
(Rept-860113-TW; ETN-87-90398) Avail: NTIS HC A05/MF A01

An automated ultrasonic inspection was performed with the ALOK system in the inspection program of the pressure vessel. Inspection with conventional probes covered selected defects of the circumferential weld M4, and the five defect planes of the circumferential weld 4/1. Evaluation of the measured data included on-line C scan presentations, and noise elimination of the ultrasonic data within the defect areas. ESA

N88-10368# Fraunhofer-Inst. fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (West Germany). Inst. fuer Zerstoerungsfreie Pruefverfahren.
STATIONARY RECONSTRUCTION METHOD. DEVELOPMENT, TEST AND COMPARISON IN ULTRASONIC TESTING [STATIONAERE REKONSTRUKTIONSVERFAHREN. ENTWICKLUNG, ERPROBUNG UND VERGLEICH BEI DER ULTRASCHALLPRUEFUNG]
K. J. Langenberg and Volker Schmitz 30 Jun. 1986 133 p In GERMAN Original contains color illustrations
(Contract BMFT-1500-659-102-644)
(Rept-860125-TW; ETN-87-90399) Avail: NTIS HC A07/MF A01

The boundary conditions for a stationary testing method for the interaction between defects and ultrasound were investigated. Models for the elastodynamic interaction between defects and ultra sound were developed for two defect geometries (crack and pore) enabling the calculation of the elastic ultrasonic scattered wave. The results were verified by measurements on special test bodies. The diffracted pressure and shear waves, including the mode-converted diffraction fields were experimentally determined in a 360 deg angular domain. They show excellent agreement with the theoretically calculated wave fronts, including the additional wave fronts due to the crack diffraction near field. ESA

N88-10369# Lawrence Livermore National Lab., Calif.
MODEL-BASED ULTRASONIC TOMOGRAPHY
S. G. Azevedo, J. P. Fitch, and G. H. Thomas 1987 9 p Presented at the Review of Progress in Quantitative NDE, Williamsburg, Va., 21 Jun. 1987 Prepared in cooperation with Sandia National Labs., Livermore, Calif.
(Contracts DE-AC04-76DR-00789; W-7405-eng-48)
(DE87-013786; UCRL-96376; CONF-870691-1) Avail: NTIS HC A02/MF A01

A standard tank for routine ultrasonic non-destructive testing has been used for collecting tomographic data. Side-wall reflections of the tank prevent the use of continuous parallel waves characteristic of most ultrasonic tomography systems. Instead, the part is insonified with unfocused chirped pulses and the transmitted A-scan is captured by a moving point-receiver. A computer-controlled rotating stage eliminates operator interaction during the collection of projections. The reconstruction process is a modified filtered back-propagation technique making use of the part structure. This is possible because the parts are often numerically milled with accurate dimensions available from the fabrication data base. In this paper, the imaging model emphasizes restrictions based on the expected scattering associated with the diffracting illumination and performance improvements by incorporating the a priori part information. DOE

N88-10370# Technical Research Centre of Finland, Espoo. Metals Lab.
IMAGING OF PLANAR DEFECTS WITH SYNTHETIC APERTURE FOCUSING TECHNIQUE (LSAFT)
Kari Lahdenpera Mar. 1987 37 p Sponsored by Nordiskt Industry, TEKES, and Nordtest
(VTT-468; ISBN-951-38-2834-4; ISSN-0358-5077; ETN-87-90737) Copyright Avail: NTIS HC A03/MF A01; Technical Research Center of Finland, Espoo, Finland FIM 40

Three specimens with internal fatique cracks were imaged by the synthetic aperture focusing technique (LSAFT). The principles of SAFT are described as well as the manufacturing of the specimens used. The results were compared with measurements by the surface wave method. The SAFT results are in good agreement with the earlier results on crack height and position. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N88-10371# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
A GENERALIZED LEAST-SQUARES DETERMINATION OF TRIAXIAL STRESS STATES BY X-RAY DIFFRACTION AND THE ASSOCIATED ERRORS
R. A. Winholtz and J. B. Cohen Jul. 1987 27 p
(Contract N00014-80-C-0116)
(AD-A183851; TR-25) Avail: NTIS HC A03/MF A01 CSCL 20K

The determination of residual stresses via X-ray diffraction is briefly reviewed, with particular emphasis on the triaxial stress state. A new method is proposed for determining the general stress tensor, which considerably reduces the variances of the stresses due to counting statistics and gradients. The procedure involves a generalized least square solution of strains measured at various tilts of the X-ray beam to the sampled and a set of tilts not heretofore used is recommended to minimize these errors. GRA

N88-10372# Technische Hochschule, Aachen (West Germany). Inst. fuer Maschinenelemente und Maschinengestaltung.
DETERMINATION OF THE FATIGUE STRENGTH OF MECHANICALLY, THERMALLY AND CORROSIVELY LOADED MULTILAYER MATERIALS Final Report [ERMITTLUNG DER ERMUEDUNGSFESTIGKEIT MECHANISCH, THERMISCH UND KORROSIV BEANSPRUCHTER MEHRSCHICHTLAGER-WERKSTOFFE]
T. Salm 1987 161 p In GERMAN
(Contract I/38059)
(ETN-87-90375) Avail: NTIS HC A08/MF A01

The fundamentals for the fatigue resistant design of journal bearings under unsteady loading were elaborated. Fatigue strength tests were performed to quantify the effects of different operational and production parameters. Metallographic and X-ray examinations, as well as the analysis of the topography of the bearing metal surfaces enabled an interpretation of the test results. The triaxial stress distribution in the bearing metal at limit loadings was numerically determined. A design procedure for journal bearings under unsteady loading was developed, enabling the transfer of uniaxially determined dynamic strength characteristics to the realistic case. ESA

N88-10373 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
CRACK PROPAGATION BEHAVIOR OF THE MATERIALS StE 460 AND AlMg 4.5Mn [RISSAUSBREITUNGSVERHALTEN DER WERKSTOFFE StE 460 UND AlMg 4.5Mn]
M. Vormwald and T. Seeger 1986 69 p In GERMAN
(FD-1/1986; ETN-87-90378) Copyright Avail: Issuing Activity

Tests were performed on cracked and notched disks in order to study the crack propagation behavior of fine-grained structural steel StE 460 and AlMg4.5Mn under oscillatory loading. From the experimental data a crack propagation law, i.e., the effective vibration amplitude as a function of the stress intensity factor, for StE460 as well as for AlMg4.5Mn was derived. An approximation formula for the calculation of the stress intensity factor under single-stage loading is given. The crack propagation behavior of cracks in notches under single and multistage loading for both materials was determined. The data can be used to check numerical crack propagation predictions. ESA

N88-10374 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
THE EFFECT OF SIZE AND SURFACE ON THE LIFETIME PREDICTION OF StE 460 NOTCHED BARS [GROESSEN- UND OBERFLAECHENEINFLUSS BEI DER LEBENSDAUERVORHERSAGE VON KERBSTAEBEN AUS StE 460]
Chr. Boller and T. Seeger 1986 151 p In GERMAN
(FD-6/1986; ETN-87-90379) Copyright Avail: Issuing Activity

The effect of the size and the surface roughness on the time and operational strength of oscillatory loaded components was investigated using the fine-grained structural steel StE460. The numerical application of the local concept for lifetime prediction is explained. A procedure which takes into account the effects of size and surface characteristics was developed. ESA

N88-10375 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
STRESS-STRAIN BEHAVIOR OF COMPONENTS SUBJECT TO RESIDUAL STRESSES TAKING THE EXAMPLE OF AN ORIFICE PLATE [SPANNUNGS-DEHNUNGS-VERHALTEN VON EIGEN-SPANNUNGSBEHAFTETEN BAUTEILEN AM BEISPIEL EINER LOCHSCHEIBE]
Armin Huss 1986 86 p In GERMAN
(FF-10/1986; ETN-87-90380) Copyright Avail: Issuing Activity

The effect of residual stresses on the stress-strain behavior of components was investigated using the finite element method. The steady and cyclic loading of an orifice plate with and without residual stresses was examined by the finite element method. The residual stresses were obtained by mandrel forming of the orifice in the disk. An approximation method to estimate the residual stress due to the forming is proposed. Three known theories for the determination of residual stresses as well as a developed theory were compared with the results of the finite element calculations. The theory of the thin boundary layer and the developed theory of the preloading prove to be suitable for the determination of residual stresses in the local stress-strain relation, in different cases. ESA

N88-10376# Max-Planck-Inst. fuer Plasmaphysik, Garching (West Germany).
SHEAR STRENGTH OF THE ASDEX UPGRADE TOROIDAL FIELD (TF) COIL INSULATION: RUPTURE, FATIGUE AND CREEP BEHAVIOR
B. Streibl, E. A. Maier, J. Perchermeier, P. L. Cimbrico, G. Varni, D. Pisani, R. Deska, J. Endreat, and R. Schaefer (Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, West Germany) Mar. 1987 35 p
(IPP-1/230; ETN-87-90565) Avail: NTIS HC A03/MF A01

The interlaminar shear strength of the insulation system for the 16 toroidal field (TF) coils of ASDEX Upgrade was assessed. The pure resin was tested in tension. The results were taken into account for setting up the method of curing the TF coils. Shear tests of the complete glass-epoxy system were conducted with tubular torque specimens providing a nearly homogeneous stress distribution. The influence of the amount of flexibilizer (5, 10, 15 parts of resin weight) on the rupture and fatigue strengths was assessed at 60 C, as was the temperature dependence of the creep rate (40, 60, 80 C). The results obtained are not based on safe statistics. Nevertheless, they show clear trends. A viscoelastic (dashpot spring) model was set up to describe the creep behavior of the insulation system. ESA

N88-10377# British Aerospace Aircraft Group, Woodford (England). Structures Dept.
THE FATIGUE PROPERTIES OF AEROSPACE STEELS UNDER CONSTANT AMPLITUDE AND FLIGHT-BY-FLIGHT SIMULATED LOADING Final Report
J. A. Forsyth Feb. 1986 34 p
(Contract MOD-A93B/1548)
(BAe-MSM-R-GEN-0566; BR99378; ETN-87-90679) Avail: NTIS HC A03/MF A01

Fatigue tests were carried out to evaluate the fatigue properties of alloy steels S99, S155 and AF1410, which span a wide range in toughness value (50 to 150 MPa square root m). The fighter aircraft loading sequence (FALSTAFF) and conventional constant amplitude loading were used for the fatigue tests. The expected tensile strength levels (specification minima) are met by the alloys S99 and S155. The AF1410 material is slightly below specification. The fatigue performance of S155 is significantly inferior to that of S99 and AF1410. ESA

N88-10378# Admiralty Research Establishment, Dunfermline (England).
INTERACTIVE BUCKLING EFFECTS IN STIFFENED FRP PANELS
C. S. Smith and R. S. Dow Mar. 1987 20 p
(ARE-TM(UMS)87204; BR102030; ETN-87-90687) Copyright Avail: NTIS HC A03/MF A01

A numerical study of the initial compressive buckling and postbuckling behavior of GRP panels reinforced by longitudinal hat-section stiffeners is described. The effects of interaction between local buckling of the panel laminate and overall, column-like buckling involving bending of the stiffeners are discussed. The influence of interactive effects on collapse strength is noted and recommendations on allowance for these effects in design are made. ESA

N88-10379 National Physical Lab., Teddington (England). Div. of Materials Applications.
MODELLING OF CRACK-TIP DEFORMATION AND TRANSIENT ELECTROCHEMICAL PROCESSES IN RELATION TO CORROSION FATIGUE OF STEELS CATHODICALLY PROTECTED IN MARINE ENVIRONMENTS
A. Turnbull and M. SaenzdeSantaMaria Apr. 1987 43 p
(NPL-DMA(A)-145; ISSN-0143-7313; ETN-87-90704) Copyright Avail: Issuing Activity

Calculated crack-tip reaction rates for a range of electrochemical and mechanical variables were compared with the current flowing on the crack walls and external surface. Cathodic reduction of water on the external surface of the steel is shown to be the dominant source of hydrogen atoms for potentials more negative than minus 900 mV (SCE) at a cyclic frequency of 0.1 Hz and this dominance is enhanced considerably by reducing the frequency. Hydrogen-atom concentration profiles in fracture mechanics specimens and in tubulars were calculated for conditions in which bulk charging of the steel with hydrogen is dominant. Crack growth data from fracture mechanics specimens may not be directly relevant to cracking in tubulars because of hydrogen concentration gradients in the latter. Surface coating is predicted to enhance fatigue life provided the integrity of the coating is retained over long periods. ESA

N88-10380 Technische Hochschule, Darmstadt (West Germany). Fachgbiet Werkstoffmechanik.
DUGDALE SOLUTIONS FOR STRAIN HARDENING MATERIALS
M. Hoffmann and T. Seeger 1985 26 p Presented at the workshop on the CTOD Methodology, Geesthacht, West Germany, 1985
(FD-6/1985; ETN-87-90780) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

Two Dugdale solutions for strain hardening materials are presented and compared to finite element results and to the HRR-field. The necessary input for a Dugdale model including strain hardening (the shape of the stress distribution within the plastic zone) is taken for the first one from finite element calculation. The second one is based on a stress distribution assumption. ESA

N88-10381 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
FATIGUE LIFE EVALUATION ACCORDING TO LOCAL STRAIN CONCEPT
Chr. Boller, P. Heuler (Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, West Germany), and T. Seeger 1985 26 p
(FF-14/1985; ETN-87-90781) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

The principal of local strain concept is discussed for numerical and experimental fatigue life evaluation procedures and proved by results. Methods dealing with size, multiaxiality, and especially sequence effects are explained and applied. With the experimental prediction methods very good results are obtained, allowing use for basic studies of fatigue life behavior under service loading. For the numerical evaluation methods, attention is drawn to damage accumulation problems and problems concerning size surface, and multiaxiality effects. Using the notch fatigue factor instead of Kt is a possibility, but it does not seem to be sufficiently powerful. ESA

N88-10382 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
ESTIMATION MULTIAXIAL ELASTIC-PLASTIC NOTCH STRESSES AND STRAINS IN COMBINED LOADING
M. Hoffmann and T. Seeger 1986 38 p Presented at the International Conference on Biaxial/Multiaxial Fatigue, Sheffield, England, 1985 Submitted for publication
(FB-2/1986; ETN-87-90782) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

A method for estimating multiaxial elastic-plastic notch stresses and strains is presented. The method assumes proportional loading and is based on approximation formulas, Hencky's equations, and notch element boundary conditions. Application is illustrated by a notched shaft under bending and torsional loading. The method can be used for fatigue life prediction if a multiaxial damage parameter is incorporated. No nonlinear finite element analyses are needed. ESA

N88-10383 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
THE USE OF HENCKY'S EQUATIONS FOR THE ESTIMATION OF MULTIAXIAL ELASTIC-PLASTIC NOTCH STRESSES AND STRAINS
M. Hoffmann and T. Seeger 1986 26 p Presented at the Sixth European Conference on Fracture, Amsterdam, The Netherlands, 1986 Sponsored by Forschungskuratorium Maschinenbau e.V., and Arbeitsgemeinschaft Industrieller Forschungsvereinigungen e.V.
(FB-3/1986; ETN-87-90783) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

A procedure for estimating notch stresses and strains of structures under proportional loading is presented. The procedure is based on a simplified handling of kinematic hardening, known local strain approximation formulas, Hencky's flow rule, and notch element boundary conditions. Application is illustrated by a notched round bar under combined loading. Hencky's rule in combination with the notch element boundary conditions proves to be an excellent tool for relating principal stresses and strains to equivalent stresses and strains. ESA

N88-10384 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
STRESS-STRAIN ANALYSIS AND LIFE PREDICTIONS OF A NOTCHED SHAFT UNDER MULTIAXIAL LOADING
M. Hoffmann and T. Seeger 1986 43 p Submitted for publication
(FB-5/1986; ETN-87-90784) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

For a notched shaft under proportional bending and torsional loading, finite element analyses are carried out. Based on the results an approximation procedure for estimating the multiaxial nonlinear notch stresses and strains is checked. Incorporating multiaxial damage parameters, the procedure is employed for crack initiation life predictions. Constant amplitude tests on notch shafts under bending, torsional, and combined loading show that the procedure can be employed successfully for fatigue life predictions where it is most important to choose the right multiaxial damage parameter for the material under consideration. The procedure is restricted to proportional loading. ESA

N88-10385 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Werkstoffmechanik.
CRACK INITIATION LIFE ESTIMATIONS FOR NOTCHED SPECIMENS WITH RESIDUAL STRESSES BASED ON LOCAL STRAINS
M. Vormwald and T. Seeger 1986 33 p Presented at the International Conference on Residual Stresses, Garmisch-Partenkirchen, West Germany, Oct. 1986
(FF-17/1986; ETN-87-90786) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

The Lawrence (1981-1984), Reemsnyder (1981), and thin surface layer models to assess the effect of residual stresses on crack initiation lives based on local strains are discussed. Estimated crack initiation lives are compared with experimental lives for constant and variable amplitude loading. If the residual stress at the critical point of a specimen is known, all three models succeed in predicting the tendency of residual stress on crack initiation life in constant and variable amplitude tests. The Lawrence model and the thin surface layer model yield similar results which are in good agreement with the experiment, whereas the Reemsnyder model tends to overestimate the effect of residual stresses. ESA

N88-10386# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
CRITERIA FOR DETERMINATION OF SIGNIFICANT LOAD CYCLES IN VARIABLE AMPLITUDE LOAD SEQUENCES
A. U. deKoning and G. Liefting 1 Mar. 1986 41 p Presented at the International Symposium on Fatigue Crack Closure, Charleston, W.Va., May 1986
(Contract NIVR-1823/01702-N)
(NLR-MP-86013-U; B8701061; ETN-87-90824) Avail: NTIS HC A03/MF A01

The crack opening behavior of a fatigue crack in a centrally cracked panel was studied using a discretized version of the Dugdale and Barenblatt model. The effect of crack growth was included. Results for constant amplitude loading agree with the literature. The effect of single overload-underload combinations and of simple block loading programs on the crack opening behavior was analyzed. The results were compared with predictions based on an empirical model (CORPUS). The criteria used in the CORPUS model to select significant load excursions in the applied load sequence were checked. Both models were used to predict crack growth under a simplified landing gear load sequence. The predicted crack opening loads and the crack growth lives agree with experiment. ESA

N88-10387# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A DMAP FOR UPDATING DYNAMIC MATHEMATICAL MODELS WITH MEASURED DATA
A. DeBoer and B. W. Kooi 11 Apr. 1986 25 p Presented at the MSC/NASTRAN European User's Conference, Munich, Fed. Republic of Germany
(Contract NIVR-1053)
(NLR-MP-86027-U; B8701064; ETN-87-90826) Avail: NTIS HC A03/MF A01

Two matrix correction methods are evaluated using a simple beam and a simple plate structure. Experimental data are obtained for the plate with an impact test and simulated in case of the beam. The structures were modelled with MSC/NASTRAN. To facilitate the comparison the Guyan reduction method was applied to calculate the natural frequencies and normal modes, and the position of the excitation points used in the tests coincide with the ASET. Both updating methods were programmed in DMAP. The results of the finite element calculation are obtained from the (old) problem tape and the experimental date are brought into the DMAP by bulk data cards. It is concluded that within MSC/NASTRAN the DMAP programming is a convenient facility to use for matrix correction methods. To guarantee the physical relevance of the updated matrices, the update methods have to be used with correlation methods. ESA

N88-10388*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ANALYSIS OF SHELL-TYPE STRUCTURES SUBJECTED TO TIME-DEPENDENT MECHANICAL AND THERMAL LOADING Semiannual Status Report
G. J. Simitses and R. Riff Oct. 1987 7 p
(Grant NAG3-534)
(NASA-CR-181409; NAS 1.26:181409) Avail: NTIS HC A02/MF A01 CSCL 20K

A general mathematical model and solution methodologies for analyzing structural response of thin, metallic shell-type structures under large transient, cyclic, or static thermomechanical loads are developed. Among the system responses, which are associated

with these load conditions, are thermal buckling, creep buckling and ratcheting. Thus, geometric as well as material type nonlinearities (of high order) can be anticipated and must be considered in the development of the mathematical model. Furthermore, this must also be accommodated in the solution procedures. Author

N88-10389*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THERMAL STRESS ANALYSIS OF SPACE SHUTTLE ORBITER SUBJECTED TO REENTRY AERODYNAMIC HEATING
William L. Ko and Roger A. Fields Oct. 1987 39 p
(NASA-TM-88286; H-1400; NAS 1.15:88286) Avail: NTIS HC A03/MF A01 CSCL 20K

A structural performance and resizing (SPAR) finite-element computer program and NASA structural analysis (NASTRAN) finite-element computer programs were used in the thermal stress analysis of the space shuttle orbiter subjected to reentry aerodynamic heating. A SPAR structural model was set up for the entire left wing of the orbiter, and NASTRAN structural models were set up for: (1) a wing segment located at midspan of the orbiter left wing, and (2) a fuselage segment located at midfuselage. The thermal stress distributions in the orbiter structure were obtained and the critical high thermal stress regions were identified. It was found that the thermal stresses induced in the orbiter structure during reentry were relatively low. The thermal stress predictions from the whole wing model were considered to be more accurate than those from the wing segment model because the former accounts for temperature and stress effects throughout the entire wing. Author

N88-10390# Los Alamos National Lab., N. Mex.
RELATION BETWEEN SHOCK STRENGTH AND STRAIN-RATE PLASTICITY AT MAXIMUM DEVIATORIC STRESS
D. L. Tonks 24 Jun. 1987 14 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-36)
(DE87-011736; LA-UR-87-2171; CONF-870753-15) Avail: NTIS HC A03/MF A01

Using Wallace's analysis for steady weak shocks, this paper establishes for Cu, Ur, and 6061T6Al an approximate relation between the shock strength and the maximum deviatoric stress, tau sub m, and plastic strain at tau sub m. In addition it is shown that the plastic strain rate is very nearly proportional to the total normal strain rate at tau sub m. These results and the universal shock strength/strain rate relation of Swegle and Grady are used to draw conclusions about the general plasticity constitutive relation. DOE

N88-10391# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
REINFORCED FLEXURAL ELEMENTS FOR TEMP-STRESS PROGRAM
A. H. Marchertas, J. M. Kennedy, and P. A. Pfeiffer Jun. 1987 52 p
(Contract W-31-109-eng-38)
(DE87-012961; ANL/RAS-87-3) Avail: NTIS HC A04/MF A01

The implementation of reinforced flexural elements into the thermal-mechanical finite element program TEMP-STRESS is described. With explicit temporal integration and dynamic relaxation capabilities in the program, the flexural elements provide an efficient method for the treatment of reinforced structures subjected to transient and static loads. The capability of the computer program is illustrated by the solution of several examples: the simulation of a reinforced concrete beam; simulations of a reinforced concrete containment shell which is subjected to internal pressurization, thermal gradients through the walls, and transient pressure loads. The results of this analysis are relevant in the structural design/safety evaluations of typical reactor containment structures. DOE

N88-10392# Lawrence Livermore National Lab., Calif.
RHEOLOGICAL BEHAVIORS OF AN ELASTOMERIC MEMBRANE
W. W. Feng Sep. 1986 3 p Presented at the 11th Canadian Congress of Applied Mechanics, Edmonton, Alberta, 31 May 1987
(Contract W-7405-eng-48)
(DE87-013105; UCRL-95340; CONF-870533-4) Avail: NTIS HC A02/MF A01

In this paper, the nonlinear viscoelastic membrane mechanics have been formulated, solved, and experimentally verified for the inflation of an initially flat thin circular membrane. With some minor modifications on these formulations, the whole class of axisymmetric viscoelastic membrane problems can be studied. In the formulation, the geometric nonlinearity as well as the material nonlinearity are included. The theoretical value for the strains can be as large as needed; for practical applications, however, these values are limited by the fracture strength and are usually less than a few hundred percent. In the formulation, the relaxation function is represented by a single exponential term that does not represent the material properties in reality. However, the formulation presented here can be extended to a more realistic relaxation function which is represented by a series of exponential functions or by the power law. The analytical results combined with the experimental results can be used further to determine the material properties of elastomers. DOE

N88-10393# Westinghouse Hanford Co., Richland, Wash.
FATIGUE CRACK PROPAGATION OF LOW-ALLOY STEEL IN A VACUUM ENVIRONMENT Final Report
L. A. James Aug. 1987 41 p Prepared in cooperation with Electric Power Research Inst., Palo Alto, Calif.
(Contract DE-AC06-76FF-02170)
(DE87-013770; EPRI-NP-5345) Avail: NTIS HC A03/MF A01

The fatigue-crack propagation (FCP) behavior of ASTM A533-B-1 steel was characterized in vacuo at 288 C. Tests were conducted at two stress ratios: R = 0.05 and R = 0.7. Results of these tests were compared with results from previous studies for the same type of steel tested in an air environment; FCP rates in vacuo were generally lower than those in air. Stress ratio effects in vacuo were not as great as those in air, and both stress ratio effects and environmental effects are discussed from the standpoint of crack closure concepts. DOE

N88-10394# Sandia National Labs., Albuquerque, N. Mex.
AN EXPERIMENTAL AND THEORETICAL STUDY OF THE BENDING BEHAVIOR OF KEVLAR 49/EPOXY BEAMS AND RINGS
T. R. Guess and E. D. Reedy, Jr. 1987 13 p Presented at the 19th National SAMPE Technical Conference, Washington, D.C., 13 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE87-010430; SAND-86-2983C; CONF-871082-1) Avail: NTIS HC A03/MF A01

The basic lamina properties were determined by testing unidirectionally reinforced specimens in tension and compression. Results indicate that unidirectional Kevlar 49/epoxy composites manifest nearly linear elastic response in tension and yield-like behavior in fiber-directed compression. The measured compressive yield strength is roughly 20% of the tensile ultimate strength. We also tested 3.2 and 12.7 mm thick, quasi-isotropic beams in tension, compression, short beam shear, and four-point bending, and 457 mm diameter, 12.7 mm thick, quasi-isotropic rings in diametral compression. All specimens were fully instrumented with strain gages to provide a detailed record of their deformation. As anticipated, the flexural response of laminated Kevlar 49/epoxy beams and rings exhibit nonlinearity. For this reason, a material model which includes compressive yield behavior was examined. In this model, a Kevlar 49 lamina is assumed to respond in a linear elastic manner to all loads except compression in the fiber direction. In fiber-directed compression, it is assumed to behave in an elastic-perfectly plastic manner. Laminate response is determined from the postulated lamina behavior in a manner analogous to that used in classical laminated plate theory. DOE

N88-10395# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.

A MIXED FINITE ELEMENT METHOD FOR THE COMPUTATION OF STRESS IN A COMPOSITE WITH LOADED HOLES Final Report [METHODES D'ELEMENTS FINIS MIXTES POUR LE CALCUL DES CONTRAINTES DANS UN COMPOSITE AU NIVEAU DES TROUS CHARGES]

J. L. Akian Nov. 1986 43 p In FRENCH
(Contract DEN-87/70.138)
(ONERA-RT-34/4242-RY-054-R; ETN-87-90649) Avail: NTIS HC A03/MF A01

A stress computation method based on assumptions regarding the stress distribution at each composite layer and a variational mixed formulation was developed. A theoretical analysis shows that the system obtained from numerical approximations has a single solution. Numerical results are included. ESA

N88-10396# Lanchester Polytechnic, Coventry (England). Dept. of Mathematics.

AN EXACT THEORY OF ELASTIC PLATES

K. E. Barrett and S. Ellis (Royal Military Coll. of Science, Shrivenham, England) Feb. 1987 36 p
(ETN-87-90675) Avail: NTIS HC A03/MF A01

It is shown how the exact solutions of the full linear elastic equations can be written in terms of a Kirchhoff boundary value problem. Many of the formulas derived are also applicable to a plate of nonuniform thickness provided the elastic material is confined between two antisymmetrically loaded, shear free surfaces. It is shown that the plate theories of Mindlin (1951) and Reissner (1945) are approximations modeling the in-plate strain gradients. It is possible to obtain Kirchhoff solutions from Mindlin or Reissner approximations. As the precise connection between approximate solutions and the exact solution is clear, and stable numerical methods based on finite elements are available for Mindlin plates, these numerical solutions may be utilized with more confidence. ESA

N88-10397# Lanchester Polytechnic, Coventry (England). Dept. of Mathematics.

CORRECTION TO A SINGLE HIGHER ORDER THEORY OF ELASTIC PLATES

K. E. Barrett Feb. 1987 6 p
(ETN-87-90676) Avail: NTIS HC A02/MF A01

The finite element analysis of homogeneous and laminated composite plates using a simple higher order theory by Ren and Hinton in Communications in Applied Numerical Methods, Vol 2 217-228 (1986) is discussed. An inconsistency between the form of the displacements assumed by Ren and Hinton and the displacements that apply in the exact theory of plates is noted. Ren and Hinton's approximations are consistent when Poisson's ratio is zero; a simple adjustment may be made in other cases. ESA

N88-10398# Technische Univ., Munich (West Germany). Fakultaet fuer Maschinenwesen.

GEOMETRICALLY NONLINEAR ROD MECHANISM ANALOGY OF AXISYMMETRICALLY LOADED SPHERICAL SHELLS BASED ON A COMPREHENSIVE APPROACH TO THE STABILITY OF CIRCULAR ARCHES Ph.D. Thesis [GEOMETRISCH NICHTLINEARE STABWERKANALOGIE ZUR ROTATIONSSYMMETRISCH BELASTETEN KUGELSCHALE AUF DER GRUNDLAGE EINER ZUSAMMENFASSENDEN STABILITAETSBETRACHTUNG AN KREISBOEGEN]

Louis Wolfgang Pousset 1986 152 p In GERMAN
(ETN-87-90419) Avail: NTIS HC A08/MF A01

A rod mechanism analogy for the description of the deformation behavior of axisymmetrically loaded spherical shells was established. A geometrically nonlinear theory for plane rods, which are circularly curved, and embedded and loaded in their plane, was derived. Instability phenomena in elastic systems are treated. A geometrically nonlinear theory for axisymmetrically loaded spherical shells was derived. The analogy between axisymmetrically loaded spherical shells and circular, elastically embedded circular arches is explained. The completeness of the analogy is demonstrated. ESA

N88-10399# Kaiserslautern Univ. (West Germany). Fachbereich Maschinenwesen.

CONTRIBUTION TO THE NUMERICAL CALCULATION OF FRACTURE-MECHANICAL QUANTITIES FOR ELASTIC AND ELASTIC-PLASTIC MATERIAL BEHAVIOR, ESPECIALLY FOR MIXED LOADS Ph.D. Thesis [BEITRAG ZUR NUMERISCHEN BERECHNUNG VON BRUCHMECHAISCHEN GROESSEN FUER ELATISCHES UND ELASTISCH-PLASTISCHES MATERIALVERHALTEN INSBESONDERE BEI GEMISCHTER BELASTUNG]

Peter Josef Maria Pirro 1986 183 p In GERMAN
(ETN-87-90435) Avail: NTIS HC A09/MF A01

The finite element program system NOLIFE was developed for the numerical calculation of fracture-mechanical quantities for elastic and elastic-plastic material behavior. The program system is characterized by its block-oriented matrix-envelope solver with special storage technique, and its modular structure which allows the integration of new elements and methods. For fracture-mechanical analysis in the elastic case, four different methods for the determination of the K-factors for pure and mixed loading were programmed. The best results are obtained with the method of J-integral splitting. Concerning the elastic-plastic material behavior, the test results with a compact tension specimen show very good agreement with calculated J-integral values. It is shown that the pull specimen with oblique inner crack is not suited for fracture mechanics investigations for small angles between pull direction and crack axis, in contrast with compact-tension-shear specimens. ESA

N88-10400# Gesamthochschule, Paderborn (West Germany). Fachbereich Maschinentechnik.

FRACTURE MECHANICAL ANALYSIS OF THE INITIATION AND PROPAGATION OF MATRIX AND SURFACE CRACKS IN THERMALLY LOADED FIBER COMPOSITE MODELS Ph.D. Thesis [BRUCHMECHANISCHE ANALYSE DER ENTSTEHUNG UND AUSBREITUNG VON MATRIX- UND GRENZFLAECHENRISSEN IN THERMISCH BELASTETEN FASERVERBUNDWERKSTOFFMODELLEN]

Ferdinand Ferber 1986 261 p In GERMAN
(ETN-87-90439) Avail: NTIS HC A12/MF A01

Thermal stress fracture in fiber reinforced composites was investigated. An equivalent model for a real fiber composite, which represents a three-dimensional continuum consisting of a matrix and hexagonally arranged cylindrical fibers, is presented. The linear-elastic fracture mechanical problem is outlined. Fracture mechanical characteristics and stress distributions in a modelled composite structure were determined using the finite-element method. The optical procedure of stress analysis is explained. Crack initiation, propagation, and sequence were experimentally determined. The eigenstress behavior of plane fiber composite materials was numerically assessed. The simulation results of the development of the matrix crack and debonding at the crack initiation fiber agree very well with experiments. ESA

N88-10401# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Betriebsnahe Ermuedungsfestigkeit.

NEW FATIGUE DAMAGE ANALYSIS OF COMPLEX ENGINEERING COMPONENTS BASED ON FINITE ELEMENT METHODS (FEM) Ph.D. Thesis - Technische Hochschule

Walter Ott May 1987 111 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-15; ISSN-0171-1342; ETN-87-90778) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany DM 35.50

A fatigue damage analysis for multiaxial elastoplastic conditions based on a three dimensional finite element analysis was developed. The analysis includes the material model after Mroz. The fatigue life evaluation in the critical areas is based on plastic work at these locations. The proposed damage concept can be

applied to arbitrary multiaxial stress-strain paths. For the evaluation of the damage cycles in terms of closed stress-strain hysteresis loops are not required. The damage is determined on the basis of uniaxial material data (stress-strain curve, life to crack initiation curve). ESA

N88-10402# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
COMPARATIVE TESTS OF HIGH TEMPERATURE CREEP-RUPTURE BEHAVIOR OF THE AUSTENITIC CrNI STEEL DIN W.NR.1.4970 IN ARGON AND STEAM
G. Schanz, S. Leistikow, and H. vonBerg May 1987 48 p In GERMAN; ENGLISH summary
(KfK-4261; ISSN-0303-4003; ETN-87-90789) Copyright Avail: NTIS HC A03/MF A01

The suitability as alternative cladding material in an advanced pressurized water reactor (APWR) of austenitic chromium nickel steel DIN 1.4970 was assessed in a laboratory investigation of its creep-rupture behavior: in parallel in argon and in steam at 950 to 1200 C, 10 to 100 bar, 1 min to 1 hr. In comparison to burst tests under inert atmosphere the oxidizing material shows slightly reduced strength combined with considerably reduced circumferential burst elongation. Above a strain maximum at 1100 C the elongations decrease with increasing temperature and duration. The extent and the influence of the oxidation on the mechanical properties is discussed on the basis of the microstructure of the oxide scale. ESA

42 GEOSCIENCES (GENERAL)

N88-10403*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTARCTIC FIELD TESTS OF SARSAT PERSONAL LOCATER BEACONS
Robert Bindschadler Aug. 1987 20 p
(NASA-TM-4008; Rept-87B0470; NAS 1.15:4008) Avail: NTIS HC A03/MF A01 CSCL 17B

Field tests of SARSAT personal locater beacons were conducted in the Antarctic to assess the viability of using these beacons to increase the safety of Antarctic field parties. Data were collected on the extent to which dry or wet snow, melting conditions, crevasse walls and snow bridges affected the ability of the SARSAT satellite to calculate an accurate position of the beacon. Average response time between beacon turn on and alert reception in McMurdo was between 4 and 5 hours for these tests. It is concluded that the SARSAT system is viable for Antarctic operations and it is recommended that it be implemented for future field operations. Because of obstruction of line-of-sight between beacon and satellite degrades the accuracy of the location calculation (particularly in wet snow), it is further recommended that field parties have sufficient numbers of beacons to insure that in an emergency, one will be able to operate from the surface. Author

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N88-10404 Deutsche Geodaetische Kommission, Munich (West Germany).
CONTROL OF THE GERMAN MAIN TRIANGULATION NETWORK BY MACROMETER MEASUREMENT 1983-1985 (KONMAC) [KONTROLLE DES DEUTSCHEN HAUPTDREIECKSNETZES DURCH MACROMETER-MESSUNGEN 1983-1985 (KONMAC)]
Rudolf Schmidt 1986 112 p In GERMAN
(Ser-B-282; ISBN-3-7696-8567-3; ISSN-0065-5317; ETN-87-90356) Copyright Avail: Issuing Activity

The survey system Macrometer, using satellite data, was employed for the establishment of a control network. The compilation of data (network points, geoid undulations, Macrometer data) is explained. The evaluation of signals received from satellites using the program system INTRF/LSQ is outlined. The different steps of the free adjustment of the KONMAC network are presented. The comparison between Macrometer and Doppler measurements, and their combination are explained. The KONMAC network is compared with other networks. ESA

N88-10405# Universite Catholique de Louvain (Belgium). Faculte des Sciences Appliquees.
STUDY ON PROPAGATION AND INVERSE SCATTERING Final Report
Piotr Sobieski, Albert Guissard, Christine Baufays, Danielle Vanhoenacker, Anne-Marie Guillaume, and Andre VanderVorst Paris, France ESA Mar. 1986 143 p
(Contract ESTEC-5285/82)
(ESA-CR(P)-2394; ETN-87-90528) Avail: NTIS HC A07/MF A01

Radar and radiometric microwave remote sensing of the sea and of the intervening atmosphere is discussed. The hydrodynamical and the electromagnetic properties of the rough sea surface are reviewed. The Burrows-Brown boundary perturbation theory is adapted to bistatic scattering by a lossy dielectric interface. Application algorithms for the synthesis of measurements and for the retrieval of physical parameters for any satellite payload, sea state, and atmospheric situation are developed, and applied to instrument and sea-atmosphere combinations. The inversion method is based on a looped procedure; it exploits the possibility of a partial decoupling between the sea and the atmosphere. The sensitivity of the inversion algorithm to first guesses and to model parameters is investigated. Utilization of frequency bands up to 300 GHz is considered. ESA

N88-10406# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
STUDY ON THE SUITABILITY OF A EUROPEAN DATA RELAY SATELLITE TO SUPPORT A SYSTEM OF REMOTE SENSING SATELLITES Final Report
Paris, France ESA 1985 57 p
(Contract ESOC-5643/83-D-JS(SC))
(ESA-CR(P)-2400; MBB-URV/149; ETN-87-90535) Avail: NTIS HC A04/MF A01

The role of a data relay satellite (DRS) for advanced remote sensing satellite systems was compared with a network of conventional ground receiving stations. Orbital geometry and dynamics, target areas, and costs were considered. The ground network solution is found to be feasible for a limited scope of operations, but the DRS to be superior for a multisatellite global network. The economics of DRS operations are improved by increasing the number of customers. ESA

N88-10407# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
ACCURACY OF GPS SURVEYING TECHNIQUE AND ITS POSSIBLE APPLICATION TO THE WEGENER PROJECT
J. B. Zielinski Sep. 1985 53 p Sponsored by Technische Hogeschool, Delft, The Netherlands
(Rept-85.3; ETN-87-90831) Avail: NTIS HC A04/MF A01

Satellite geodesy in the Mediterranean region (Wegener project), using the GPS technique, was studied as to mobile laser site surveying, intraplate deformation study, and completion of the main Wegener-MEDLAS network. The precision of the baseline determination was assessed, and its sensitivity to different bias and error sources tested by numerical simulations. The factor which influences the results most seriously is orbit inaccuracy, but this influence is not so grave as previously supposed. With the future 18 satellite constellation and present orbital accuracy the precision

10 to the minus 7th power for 100 km baselines should be possible. ESA

N88-10408# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
ESTIMABILITY OF POTENTIAL COEFFICIENTS FROM ORBIT PERTURBATIONS
E. Schrama Aug. 1986 25 p
(Rept-86.1; B8709223; ETN-87-90832) Avail: NTIS HC A03/MF A01

The relation between the Earth's gravity field and variations in orbit parameters describing the motion of a near Earth spacecraft is introduced using linear perturbation theory. A reference trajectory is defined by three constant and three linear (with respect to time) Kepler elements; the Lagrange planetary equations are integrated along the reference orbit which facilitates the solution of the six differential equations. Using the results of the linear perturbations theory a link can be made to the lumped coefficients, which take the form of a harmonic expansion in the argument of perigee. The terms in the expansion are linear combinations of potential coefficients of the same order. Constraint equations for groups of potential coefficients are obtained. The constraints are specific for an observation type and a resonant effect. To estimate the potential coefficients, information such as degree variance data or actual observations of independent sources must be introduced. ESA

N88-10409# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
REGULARITY PROPERTIES OF A DOUBLY DEGENERATE EQUATION IN HYDROLOGY
C. J. vanDuijn and Zhang Hongfei (Tsinghua Univ., Beijing, China) 1987 65 p Sponsored by the Dutch Ministry of Education and Sciences
(Rept-87-07; B8709668; ISSN-0920-8577; ETN-87-90840)
Copyright Avail: NTIS HC A04/MF A01

The regularity of solutions of a boundary value problem with time and space parameters is assessed. An example is the evolution in time of the interface between fresh and salt ground water under certain simplifying assumptions on the flow field. ESA

N88-10410# Physics and Electronics Lab. TNO, The Hague (Netherlands).
MOISTURE DETERMINATIONS IN AND UNDER VEGETATION CANOPIES. PART 2: RESULTS AFTER PARAMETERIZATION OF THE CLOUD MODEL
G. P. deLoor Dec. 1986 38 p
(FEL-1986-63; TD-87-0051; ETN-87-90861) Avail: NTIS HC A03/MF A01

The CLOUD one layer vegetation model was parameterized. Calculations to determine the influence of soil moisture content and biomass on the radar backscatter as a function of frequency can be made. It is clear that soil moisture and biomass determinations need different frequencies and incidence angles. A 75 deg grazing angle is optimum for soil moisture measurements (minimum interference by the canopy), while 45 and 20 deg are better for obtaining information on the actual canopy itself (minimum interference by the underlying soil). The lower angle is used in SLAR observations, while 45 deg seems more realistic for observation from space. ESA

N88-10411*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
ESTIMATING REGIONAL EVAPOTRANSPIRATION FROM REMOTELY SENSED DATA BY SURFACE ENERGY BALANCE MODELS Annual Report, 15 May 1986 - 14 Feb. 1987
Ghassem Asrar, Edward Kanemasu, R. B. Myneni, R. L. Lapitan, T. R. Harris, J. M. Killeen, D. I. Cooper, and C. Hwang 14 Feb. 1987 64 p
(Grant NAG5-389)
(NASA-CR-181400; NAS 1.26:181400) Avail: NTIS HC A04/MF A01 CSCL 08H

Spatial and temporal variations of surface radiative temperatures of the burned and unburned areas of the Konza tallgrass prairie were studied. The role of management practices, topographic conditions and the uncertainties associated with in situ or airborne surface temperature measurements were assessed. Evaluation of diurnal and seasonal spectral characteristics of the burned and unburned areas of the prairie was also made. This was accomplished based on the analysis of measured spectral reflectance of the grass canopies under field conditions, and modelling their spectral behavior using a one dimensional radiative transfer model. Author

N88-10412# Utah State Univ., Logan.
REMOTE SENSING-ARID LANDS WORKSHOP, PAGE, ARIZONA, JUNE 10-12, 1986 Workshop Summary Report
R. H. Hawkins, F. J. Wobber, and E. P. Springer May 1987 32 p Workshop held in Page, Ariz., 10-12 Jun. 1986 Prepared in cooperation with DOE, Washington, D.C. and Los Alamos National Lab., N. Mex.
(DE87-012368; DOE/ER-0321; CONF-860618-Summ) Avail: NTIS HC A03/MF A01

This report describes research sponsored by the US Department of Energy (DOE) Office of Energy Research to evaluate advanced remote sensing technologies for environmental research. The program denoted as REFLEX (REmote FLuvial EXperiments) stresses new applications of remote sensing systems and advanced digital analysis to the solution of environmental problems from energy development. REFLEX experiments are being conducted at sites within the continental United States and Alaska. The experiments described here are being done on arid and semiarid sites in the western United States. Currently, two REFLEX experiments are being conducted in arid/semiarid ecosystems. At the Pacific Northwest Laboratory (PNL) in Richland, Washington, the REFLEX experiment will test hypotheses on the prediction of evapotranspiration (ET) over arid landscapes. The heterogeneity of arid and semiarid landscapes makes estimation of ET over an area quite difficult, and remote sensing, both aerial and ground based, offers tremendous potential in solving this sampling problem. The second REFLEX experiment in arid/semiarid ecosystems is being conducted on surface hydrology and soil erosion in arid watersheds. Two study sites, the Plutonium Valley Watershed at the Nevada Test Site and Walnut Gulch Experimental Watershed at Tombstone, Arizona, have been selected for the experiment. Remote sensing will be used to initialize and parameterize hydrologic models that can predict watershed responses to change on two spatial and temporal scales. DOE

N88-10413# Lockheed Engineering and Management Services Co., Inc., Las Vegas, Nev.
WET DEPOSITION AND SNOWPACK MONITORING OPERATIONS AND QUALITY ASSURANCE MANUAL
D. J. Chaloud, L. R. Todechiney, R. C. Metcalf, and B. C. Hess Jun. 1987 139 p
(Contract EPA-68-03-3249)
(PB87-212817; EPA/600/8-87/024) Avail: NTIS HC A07/MF A01 CSCL 08L

The manual (user's guide) describes the quality assurance plan and operations protocol for a comparative study of snow collection instruments being conducted on Mt. Evans. Instruments to be compared include the Aerochem Metrics Model 301 wet/dry deposition collector, the Belfort Model 780-5 weighing rain gage, and the 18 inch diameter flanged bulk samplers. In addition, ground measurements are made to provide a ground truth standard. Primary project objectives include assessment of operational reliability, estimation of inter-instrument and temporal variability, comparison of water equivalent and matrix chemistry between the collection devices and ground measurements, and recommendation of instruments and sampling intervals for future high altitude, complex terrain monitoring. GRA

N88-10414*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTROMETRIC TEST OF A LINEAR ARRAY SENSOR

Kenneth S. Brown and Moon S. Kim (Operations Research, Inc., Rockville, Md.) Jan. 1987 30 p
(NASA-TM-100676; Rept-87B0189; NAS 1.15:100676) Avail: NTIS HC A03/MF A01 CSCL 14B

A spectroradiometer which measures spectral reflectivities and irradiance in discrete spectral channels was tested to determine the accuracy of its wavelength calibration. This sensor is a primary tool in the remote sensing investigations conducted on biomass at NASA's Goddard Space Flight Center. Measurements have been collected on crop and forest plants both in the laboratory and field with this radiometer to develop crop identification and plant stress remote sensing techniques. Wavelength calibration is essential for use in referencing the study measurements with those of other investigations and satellite remote sensor data sets. This calibration determines a wavelength vs channel address conversion which was found to have an RMS deviation of approximately half a channel, or 1.5 nm in the range from 360 to 1050 nm. A comparison of these results with those of another test showed an average difference of approximately 4 nm, sufficiently accurate for most investigative work. Author

N88-10415* National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES (ISSUE 55)
Nov. 1987 113 p
(NASA-SP-7041(55); NAS 1.21:7041(55)) Avail: NTIS HC A06 CSCL 05B

This bibliography lists 368 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1 and September 30, 1987. Emphasis is placed on the use of remote sensing and geographical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N88-10416# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO GEODESY, PHOTOGRAMMETRY, AND CARTOGRAPHY. SERIES 2, NUMBER 45
1986 50 p
(ISSN-0469-4244; ETN-87-91099) Avail: NTIS HC A03/MF A01

A method resolving an ambiguity of measured distances by means of NAVSTAR GPS signals; the program Digital Situation Model, Measurement; and Digital Name Data Base Antarctic as a component of a landscape data base of the Antarctic are discussed. For individual titles, see N88-10417 through N88-10420.

N88-10417# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A METHOD RESOLVING AN AMIBIGUITY OF MEASURED DISTANCES BY MEANS OF NAVSTAR GPS SIGNALS
Jiyu Liu *In its* Contributions to Geodesy, Photogrammetry and Cartography. Series 2, Number 45 1986 p 5-7 (For primary document see N88-10416 01-43)
Avail: NTIS HC A03/MF A01

A means to resolve the ambiguity arising from the confidential nature of the PN coding used in the Global Positioning System (GPS) is suggested. The method can be used in constructing a portable GPS receiver. ESA

N88-10418# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE PROGRAM DSMME: DIGITAL SITUATION MODEL, MEASUREMENT
Hermann Neubauer *In its* Contributions to Geodesy, Photogrammetry, and Cartography. Series 2, Number 45 1986 p 9-26 (For primary document see N88-10416 01-43)
Avail: NTIS HC A03/MF A01

An interactive measurement program for topographic maps of any scale is described. The map is treated as a continuous mosaic of segments of homogeneous land use, and not as a set of line elements. Consequently, the program must convert lines into edges and mesh these. This is done under operator control while viewing the stereoscopic model. To facilitate operation, the plotting instrument was equipped with a menu board and a graphics display unit, and panel keys were reassigned. Substantial parts of the program are applied in practice. ESA

N88-10419# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL NAME DATA BASE ANTARCTIC AS A COMPONENT OF A LANDSCAPE DATA BASE OF THE ANTARCTIC
Heinz Schmidt-Falkenberg *In its* Contributions to Geodesy, Photogrammetry, and Cartography. Series 2, Number 45 1986 p 27-4 (For primary document see N88-10416 01-43)
Avail: NTIS HC A03/MF A01

A German language data base of names for the Antarctic is discussed. Orthography of topographic/geographic names is reviewed. ESA

N88-10420# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
OBJECT-DEPENDENT ATMOSPHERIC INFLUENCE ON LANDSAT RECORDINGS
Bernd-Siegfried Schulz *In its* Contributions to Geodesy, Photogrammetry, and Cartography. Series 2, Number 45 1986 p 43-48 (For primary document see N88-10416 01-43)
Avail: NTIS HC A03/MF A01

A method for determining object and direction-dependent radiometric effects caused by changes in the state of the atmosphere, showing as local interference on multispectral LANDSAT recording, was developed. Further radiometric effects, of comparatively high frequency and due to varying terrain inclinations, are suppressed by ascertaining object-dependent and area-specific mean gray values. The approach assumes that the sum of all positive and negative inclination within a specific area of analysis approximates 0, and that the mean of the related measured values reaches the value for horizontal terrain. Investigations on a LANDSAT-2 data set that almost entirely covers the area of a sheet of the General Topographic Map 1: 200,000 of the Federal Republic of Germany are summarized. ESA

N88-10421# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabteilung Angewandte Datentechnik.
REMOTE SENSING WITH LANDSAT 5 THEMATIC MAPPER (TM) AND ITS APPLICATION TO VARIOUS PLANNING LEVELS: A CASE STUDY FROM THE WUERZBURG AREA, WEST GERMANY
Ruediger Glaser Nov. 1985 133 p In GERMAN; ENGLISH summary Original contains color illustrations
(DFVLR-FB-86-62; ISSN-0171-1342; ETN-87-90595) Avail: NTIS HC A07/MF A01; DFVLR, Cologne, West Germany DM 57.50

Part of a LANDSAT Thematic Mapper (TM) scene is taken to demonstrate the applicability of remote sensing techniques to various planning levels. Standard digital image processing techniques are presented, and the information obtained is compared to that derived from visual interpretation. A quantitative land classification of the scene shows that TM data can be effectively used on the local planning level. ESA

N88-10055# Joint Publications Research Service, Arlington, Va.
STUDY OF EARTH FROM SPACE AND STRENGTHENING OF ECONOMY
Yu. P. Kiyenko *In its* USSR Report: Space 22 Apr. 1987 p 115-126 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 16-25 (For primary document see N88-10050 01-12)
Copyright Avail: NTIS HC A08/MF A01

document see N88-10050 01-12)
Copyright Avail: NTIS HC A08/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N88-10422 British Petroleum Co. Ltd., London (England).
APPARATUS FOR STORING KINETIC ENERGY Patent Application
Ian Duff-Barclay, inventor and Rayner Michael Mayer, inventor 21 May 1986 17 p Filed 30 Oct. 1985 Priority 3 Nov. 1984 GB 8427875
(EP-Patent-0-181-736-A1; EP-Patent-Appl-SN-85307847.5; Int-Patent-Class-F16F-15/30; Int-Patent-Class-F16C-15/00; ETN-87-98635) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A kinetic energy storage system comprising a flywheel mounted on a rotatable shaft, mounted on bearings, is presented. The flywheel is located in a housing constructed to contain the flywheel or fragments thereof in the event of failure. Means for maintaining a reduced pressure within the housing, and to effect cooling, preferably by circulating oil, of the bearings on which the rotatable shaft is mounted are provided. Sensors measure oil temperature, oil pressure, speed of rotation of the flywheel, vibration of the housing, and pressure within the housing. A monitor capable of interpreting signals from the sensors and determining whether the system is operating within predetermined parameters is included. ESA

N88-10423# Iowa State Univ. of Science and Technology, Ames. Microelectronics Research Center.
HIGH-EFFICIENCY SILICON SOLAR CELLS: NUMERICAL MODELING, TRANSIENT MEASUREMENTS, EFFICIENCY GOALS, AND V-SHAPED GROOVES
P. A. Basore Jul. 1987 117 p
(Contract DE-AC04-76DP-00789)
(DE87-012842; SAND-87-7112) Avail: NTIS HC A06/MF A01

This is the final report summarizing concentrator solar cell research activity at Iowa State University under contract to Sandia National Laboratories from March 1985 to September 1986. A new one-dimensional semiconductor device analysis program for personal computers, PC-1D, is presented with emphasis on its application to modeling solar cells. Two applications of this program are described: (1) the validation of a new fast-transient technique for determining the relative importance of recombination in the emitter and base regions of planar silicon solar cells; and (2) the estimation of practical efficiency goals for production solar cells both for concentrators and one-sun applications. A laboratory investigation into etching v-shaped grooves in (100)-oriented silicon is also described. DOE

N88-10424# Sandia National Labs., Albuquerque, N. Mex.
RECENT PROGRESS IN MAGMA ENERGY EXTRACTION
A. Ortega, J. C. Dunn, T. Y. Chu, R. P. Wemple, and C. E. Hickox 1987 8 p Presented at the 5th Geothermal Program Review, Washington, D.C., 14 Apr. 1987 Prepared in cooperation with Utah Univ., Salt Lake City
(Contract DE-AC04-76DP-00789)
(DE87-013083; SAND-87-0923C; CONF-8704110-13) Avail: NTIS HC A02

Ongoing research in the area of Magma Energy Extraction is directed at developing a fundamental understanding of the establishment and long term operation of an open, direct-contact heat exchanger in a crustal magma body. The energy extraction rate has a direct influence on the economic viability of the concept. An open heat exchanger, in which fluid is circulated through the interconnecting fissures and fractures in the solidified region around drilling tubing, offers the promise of very high rates of heat transfer. This paper discusses recent research in five areas: (1) fundamental mechanisms of solidifying and thermally fracturing magma; (2) convective heat transfer in the internally fractured solidified magma; (3) convective flow in the molten magma and heat transfer from the magma to the cooled heat exchanger protruding into it; (4) numerical simulation of the overall energy extraction process; and (5) the thermodynamics of energy conversion in a magma power plant at the surface. The studies show that an open heat exchanger can be formed by solidifying magma around a cooled borehole and that the resulting mass will be extensively fractured by thermally-induced stresses. DOE

N88-10425# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ENGINEERING PRINCIPLES AND CONCEPTS FOR ACTIVE SOLAR SYSTEMS
B. D. Hunn, ed., N. Carlisle, ed., G. Franta, ed., and W. Kolar, ed. Jul. 1987 291 p
(Contract DE-AC02-83CH-10093)
(DE87-001181; SERI/SP-271-2892) Avail: NTIS HC A13

This publication is a much refined and updated version of a solar design handbook originally prepared in 1978 to accompany a series of week-long courses conducted in support of the Solar Federal Buildings Program. The 1978 material was published in 1981 as the Solar Design Workbook (SERI/SP-62-308). This current document represents the culmination of an eight-year effort to compile a comprehensive state-of-the-art reference and instructional tool for practicing design professionals, architects, and engineers. It is intended to cover all phases of the design and installation of active solar energy systems for buildings. Although it contains many design guidelines, the emphasis is on providing sufficient knowledge of how these systems work to allow an engineer or architect to make well-informed decisions. It is aimed primarily at commercial building applications, but most of the material is also applicable to residential buildings. DOE

N88-10426# Tennessee Univ., Knoxville. Dept. of Chemistry.
SYNTHESIS OF NOVEL ACID ELECTROLYTES FOR PHOSPHORIC ACID FUEL CELLS Annual Report, May 1986 - Apr. 1987
J. L. Adcock Jun. 1987 32 p
(Contract GRI-5084-260-1090)
(PB87-221305; GRI-87/0193) Avail: NTIS HC A03/MF A01
CSCL 10B

Construction of a 40 mmole per hour scale aerosol direct fluorination reactor was completed June 26, 1986. F-methyl F-4-methoxylbutanoate and F-4-methoxybutanoyl fluoride were synthesized by aerosol direct fluorination of methyl 4-methoxybutanoate. Basic hydrolysis of the perfluorinated derivatives produce sodium F-4-methoxybutanoate which was pyrolyzed to F-3-methoxy 1-propene. F-3-ethoxy 1-propene, F-3,3-dimethylbutene, and F-3 (2-methoxyethoxy) 1-propene were prepared in a similar manner. Ten, six, and seven gram samples of the first three compounds were provided to other GRL contractors for synthesis of perfluorinated sulfur (VI) and phosphorous (V) acids. GRA

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N88-10427# Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
INVESTIGATIONS OF THE DISPERSION OF SPONTANEOUSLY RELEASED HEAVY GASES [UNTERSUCHUNGEN ZUR AUSBREITUNG SPONTAN FREIGESETZTER SCHWERER GASE]
Irene Fischer-Burns 1987 121 p In GERMAN; ENGLISH

summary Sponsored by Ministers fuer Umwelt, Naturschutz und Reaktorsicherheit
(WA-81; ETN-87-90373) Avail: NTIS HC A06/MF A01; Fachinformationzentrum, Karlsruhe, Fed. Republic of Germany DM 24

A top hat model, based on energy conservation, was developed for the dispersion of instantaneously released heavy gases at air temperature. The energy balance equation used involves only the kinetic energy of the mean motion and the available potential energy. In the energetically consistent model, cloud slumping after release starts realistically from rest, assuming a three-dimensional, radially symmetric velocity field. The free parameters of the model are determined using data from field experiments. The edge entrainment coefficient thus obtained is consistent with the appropriate parameter fitted to wind tunnel data. The model results were compared with those of Picknett's model and with data not used in fitting the parameters. The concentration predictions are only satisfactory for low densimetric Froude numbers. The ratio of the modeled concentration to the measured peak concentration in the front vortex is estimated. ESA

N88-10428# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Meteorologische Fernerkundung.
REMOTE SENSING OF ENVIRONMENTAL POLLUTION
Karl-Theodor Kriebel Mar. 1987 111 p Course held in Buenos Aires, Argentina, 18 Oct. - 2 Nov. 1982
(DFVLR-Mitt-87-04; ISSN-0176-7739; ETN-87-90590) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany, DM 35

Scattering, absorption, emission, and radiative transfer in the atmosphere; the principles of remote sensing; atmospheric correction of satellite data; and monitoring of atmospheric aerosols and trace gases were discussed. ESA

N88-10429# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CARBON MONOXIDE (CO) CONCENTRATION IN THE AIR AS A PURITY PARAMETER [A CONCENTRACAO DE MONOXIDO DE CARBONO (CO) NO AR COMO PARAMETRO DE PUREZA]
V. W. J. H. Kirchhoff and E. V. A. Marinho Jul. 1987 31 p In PORTUGESE Presented at the 39th Annual Conference of the SBPC, Brasilia, Brazil, 12-18 Jul. 1987 Sponsored in part by FNDCT
(INPE-4232-PRE/1107) Avail: NTIS HC A03/MF A01

Carbon monoxide (CO) is a natural component of the atmosphere and is part of important chemical cycles, especially as ozone references. Processes of combustion can add CO to the atmosphere, and in this case can represent a precursor of ozone. To determine quantitatively how far large industrial centers affect the atmosphere of natural ecosystems, the Ozone Laboratory of INPE recently installed an ultra-sensitive CO sensor capable of detecting several parts per billion CO. Initial measurements were achieved in Sao Jose dos Campos, Cachoeira Paulista, Via Dutra, Belem (PA), and Horto Florestal de Campos do Jordao. The major concentrations were observed in Sao Jose dos Campos where the concentrations were greater than from Horto Florestal by a factor of 3 to 6 times. The concentration measurements on the surface were greatest in the morning, decreasing through dilution in the mixing layer about 2 hours before the middle of the day.
Author

N88-10430*# Environmental Research Inst. of Michigan, Ann Arbor.
SPATIAL CHARACTERIZATION OF ACID RAIN STRESS IN CANADIAN SHIELD LAKES Progress Report, 1 Feb. - 1 Aug. 1987
Fred J. Tanis 1987 20 p
(Contract NAS5-28779)
(NASA-CR-181136; NAS 1.26:181136; Rept-189400-25-L) Avail: NTIS HC A03/MF A01 CSCL 13B

An analysis was performed to interpret the spatial aspects of lake acidification. Three types of relationships were investigated based upon the August to May seasonal scene pairing. In the first type of analysis ANOVA was used to examine the mean Thematic Mapper band one count by ecophysical strata. The primary difference in the two ecophysical strata is the soil type and depth over the underlying bedrock. Examination of the August to May difference values for TM band one produced similar results. Group A and B strata were the same as above. The third type of analysis examined the relationship between values of the August to May difference from polygons which have similar ecophysical properties with the exception of sulfate deposition. For this case lakes were selected from units with sandy soils over granitic rock types and the sulfate deposition was 1.5 or 2.5 g/sq m/yr.
Author

N88-10431*# Environmental Research Inst. of Michigan, Ann Arbor.
SPATIAL CHARACTERIZATION OF ACID RAIN STRESS IN CANADIAN SHIELD LAKES Progress Report, 1 Aug. 1986 - 1 Feb. 1987
Fred J. Tanis 1987 14 p
(Contract NAS5-28779)
(NASA-CR-180577; NAS 1.26:180577; Rept-189400-24-L) Avail: NTIS HC A03/MF A01 CSCL 13B

The acidification of lake waters from airborne pollution is of continental proportions both in North America and Europe. A major concern of the acid rain problem is the cumulative ecosystem damage to lakes and forest. The number of lakes affected in northeastern U.S. and on the Canadian Shield is though to be enormous. How seasonal changes in lake transparency are related to annual acidic load was examined. The relationship between variations in lake acidification and ecophysical units was also examined. The utility of Thematic Mapper based observations to measure seasonal changes in the optical transparency in acid lakes was investigated. The potential for this optical response is related to a number of local ecophysical factors with bedrock geology being, perhaps, the most important. Other factors include sulfate deposition, vegetative cover, and terrain drainage/relief. The area of southern Ontario contains a wide variety of geologies from the most acid rain sensitive granite quartzite types to the least sensitive limestone dolomite sediments. Annual sulfate deposition ranges from 1.0 to 4.0 grams/sq m. Author

N88-10432*# Kentucky Univ., Lexington.
A STUDY OF CARBON MONOXIDE DISTRIBUTION DETERMINATIONS FOR A GLOBAL TRANSPORT MODEL Semiannual Progress Report, 1 May - 31 Oct. 1987
Leonard K. Peters and James O. Manning 3 Nov. 1987 10 p
(Grant NAG1-707)
(NASA-CR-181423; NAS 1.26:181423) Avail: NTIS HC A02/MF A01 CSCL 13B

A system of programs which model the chemistry and transport of carbon monoxide and methane in the Earth's atmosphere on a global scale was installed onto the NASA-Langley central scientific computer network. This system, the GLOBAL system, consists of a user-friendly set of procedural files which allow for simplified pre-processing, execution, and post-processing for all program elements. The package includes procedures for obtaining the NMC meteorological data, calculating the vertical winds to satisfy mass conservation, determining the boundary layer, and executing the transport/chemical model for carbon monoxide. In addition, plotting, saving to tape, and reading from tape routines were developed. Final modifications to the subprograms for processing the input data for the transport/chemistry model have improved these data to more accurately reflect true atmospheric conditions. The transfer of the transport/chemistry model from the NCAR CRAY system to the NASA-Langley VPS-32 system was completed. The problems encountered during this process and their resolutions are discussed. B.G.

N88-10433# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Umweltmeteorologie.
AN INSTRUMENT FOR THE QUASI-CONTINUOUS DETERMINATION OF ATMOSPHERIC SOOT CONTENT
Bernhard Neureither, Josef Lidl, and Dieter Paffrath Oct. 1986 42 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-04; ISSN-0171-1342; ETN-87-90451) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 15

An instrument for the direct measurement of soot emissions was developed and calibrated. The measuring method is based on the measurement of light absorption in soot particles deposited on glass fiber filters. The method can determine soot concentrations in the range between 0.1 and greater than 100 microg/cu m air. The accuracy of the determination of the extinction coefficient of the aerosol particles deposited on the filters is +/- 20%. Another error is due to the assumption that the absorption is only due to soot; in dirty atmospheres this error can be 5%. ESA

N88-10434# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Umweltmeteorologie.
INVESTIGATION OF LARGE SCALE IMPACT OF AIR POLLUTION COMPONENTS ON FOREST ECOSYSTEMS IN BAVARIA, WEST GERMANY
Dieter Paffrath and Wolfgang Peters Apr. 1987 175 p In GERMAN; ENGLISH summary Sponsored by Bayerischen Staatsministerium fuer Landesentwicklung und Umweltfragen, West Germany
(DFVLR-FB-87-17; ISSN-0171-1342; ETN-87-90779) Avail: NTIS HC A08/MF A01; DFVLR, Cologne, West Germany DM 47.50

On the basis of large scale concentration distributions of SO2, NOx, ozone, and acidity forming particles over forest damage areas, measured by aircraft and van, typical average impact distributions were obtained. The impact of polluted fog on forests was investigated. No direct effects of gaseous SO2 and NOx can be detected. However, serious forest damage seems to prevail in areas where the average ozone concentration is highest. A clear influence of polluted fog on forest disease is not found. ESA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N88-10435 Illinois Univ., Urbana-Champaign.
THEORETICAL AND LIDAR STUDIES OF THE SEASONAL AND NOCTURNAL VARIATIONS OF THE MESOSPHERIC SODIUM LAYER AT URBANA, ILLINOIS Ph.D. Thesis
David George Voelz 1987 214 p
Avail: Univ. Microfilms Order No. DA8711896

Lidar measurement of the noctural mesospheric sodium layer, obtained between December 1980 and May 1986 at Urbana, Illinois, is presented and examined. A study of the seasonal characteristics of the layer indicates a maximum column abundance value in the winter, which is approximately 4.5 times larger than the summer minimum value of 2.15 x 10 to the 9th/sq cm. Also in midwinter, the layer centroid height is about 1.5 km lower than the yearly average value of 92 km. The semidiurnal tide is apparently responsible for a 36 percent peak-to-peak abundance variation in the average noctural layer. The Urbana data were analyzed to obtain estimates of monochromatic gravity wave parameters. The characteristics of the waves are compared with radar measurements of gravity wave activity and theoretical models of wave saturation and dissipation phenomena. The vertical and horizontal wavelengths show a strong tendency to increase with the observed period. Simultaneous measurements at Urbana, Illinois, and at the Air Force Geophysics Laboratory near Boston, Massachusetts, show substantial differences in the layer structure at the two sites. The most striking feature of the measurements is layer centroid heights at Boston, which are 1 to 3 km lower than those in Urbana. Possible mechanisms that could account for the differences are discussed. Dissert. Abstr.

N88-10436# Royal Netherlands Meteorological Inst., De Bilt.
A BAROCLINIC WAVY BASIC STATE MODEL: DESCRIPTION AND PRELIMINARY EXPERIMENTS
C. J. Kok 1987 52 p
(Grant NOAA-NA84AA-H-00026)
(KNMI-WR-87-1; B8707545; ISSN-0167-1651; ETN-87-90814)
Copyright Avail: NTIS HC A04/MF A01

A linear baroclinic wavy basic state model for the planetary scales in the atmosphere was developed. It is a global two layer steady state model based on the primitive equations. The model variables describe the anomalous zonally asymmetric and symmetric circulation in the time-mean atmosphere as a response to prescribed anomalous forcings. The model is semispectral: the variables are expressed in wave components in zonal direction, whereas a gridpoint representation is used in meridional direction. Experiments show that incorporating zonal structure in the basic state at the location of the heating can be very important. Incorporating in the tropics a longitudinally asymmetric basic state which includes a duct in which the zonal winds are westerly, can have a large influence on the cross-equatorial propagation of forced waves. Background flow can provide an additional source of energy by interacting with the perturbation waves. ESA

N88-10437# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DIAGNOSTICS OF ATMOSPHERIC CHEMISTRY THROUGH OZONE MEASUREMENT [DIAGNOSTICO SOBRE A QUIMICA DA ATMOSFERA ATRAVES DE MEDIDAS DE OZONIO]
V. W. J. H. Kirchhoff Jul. 1987 24 p In PORTUGESE
Presented at the 39th Annual Meeting of the SBPC, Brasilia, Brazil, 12-18 Jul. 1987 Sponsored in part by FNDCT
(INPE-4230-PRE/1105) Avail: NTIS HC A03/MF A01

The results presented are the primary ozone data collected in the Sao Jose dos Campos region, and it reveals, for the first time, some characteristics of the temporal variations through which measured ozone concentrations pass approximate to the surface area. Ozone is a natural gas of the atmosphere not a pollutant, it becomes more difficult every time not to encounter ecosystems not affected through elements artificially added to the atmosphere, which can interfer with the ozone chemistry. Advantageous to the stratosphere, where it absorbs ultraviolet radiation, when in excess in the troposphere, as a result of combustion process, ozone is a toxic gas, which can damage living conditions. Ozone measurements are presented for surface areas of diverse ecosystems with the objective of obtaining its diurnal variations. The O3 measurements at Sao Jose dos Campos during a 13 month period show seasonal and meteorological influences. The concentrations from which the results were obtained were greater in the remote stations of Cuiaba (MT), Belem (PA), and Manaus (AM), the diurnal variations were in good agreement with the approximate maximum in the middle of the day and minimum during dawn. Author

N88-10438# National Oceanic and Atmospheric Administration, Washington, D. C.
BALLOON-BASED INFRARED SOLAR OCCULTATION MEASUREMENTS OF STRATOSPHERIC O3, H2O, HNO3 AND CF2Cl(SUB 2)
Michael P. Weinreb and I-Lok Chang (American Univ., Washington, D. C.) Sep. 1987 34 p
(NOAA-TR-NESDIS-34) Avail: NTIS HC A03/MF A01

In July 1985 an infrared solar occultation experiment was performed with a balloon-borne, non-scanning, multi-detector grating spectrometer. From the data were retrieved simultaneous mixing ratio profiles of ozone, water vapor, nitric acid, and CFC-12 between 12 and 35 km. The retrieved ozone and water vapor profiles were compared with concurrent in-situ measurements with

electrochemical concentration cells (ECCs) and frost-point hygrometers, respectively. The retrieved ozone profile was in good agreement with the correlative data. The retrieved values of water vapor mixing ratio, while close in magnitude to the correlative measurements, differed in their altitude dependence. Although there was no concurrent in-situ data for nitric acid and CFC-12, the retrieved profiles were consistent with measurements in the literature. Author

N88-10439# National Center for Atmospheric Research, Boulder, Colo.
KINETICS INVESTIGATIONS OF ATMOSPHERIC CHEMICAL REACTIONS Ph.D. Thesis
A. J. Hills 1987 117 p
(Grant NSF ATM-82-17015)
(PB87-213351; NCAR/CT-107) Avail: NTIS HC A06/MF A01 CSCL 04A

Two gas-phase kinetics investigations were performed using a low-pressure, fast-flow system with mass spectrometric detection. The first investigation was a study of the rates of the reactions of diatomic sulfur, S2, with O, O2, O3, N2O, NO, and NO2 at 409 K and low pressure (0.89 to 3.0 Torr). The reaction with atomic oxygen was found to be fast. Under the experimental conditions, S2 did not react with any of the other species, but upper limits to the reaction rate constants are reported. The second investigation was a study of the synergistic coupling of atmospheric bromine and chlorine chemistry. It is concluded that the ClO + BrO reaction could account for a large fraction of the spring-time ozone hole reported recently, provided that at least 20 ppt of total inorganic bromine is present, and it may provide a source of chlorine dioxide of sufficient magnitude to explain the recent measurements of this species in the Antarctic stratosphere. GRA

N88-10440# Alaska Univ., Fairbanks. Geophysical Inst.
SOLAR ENERGY METEOROLOGICAL RESEARCH AND TRAINING SITE, ALASKA
G. Wendler 28 Jul. 1987 10 p
(Contract DE-FG06-77ET-20181)
(DE87-013706; DOE/ET-20181/T1) Avail: NTIS HC A02/MF A01

The report briefly describes research results in the following areas: (1) radiation over snow; (2) Alaskan solar radiation data analysis; (3) turbidity measurements in the Alaskan region; (4) El Chichon volcanic cloud; (5) multiple reflection effects; and (6) cirrus cloud effects on solar radiation. DOE

N88-10441# Lawrence Livermore National Lab., Calif.
STATUS OF THE SOLAR AND INFRARED RADIATION SUBMODELS IN THE LLNL 1-D AND 2-D CHEMICAL-TRANSPORT MODELS
K. E. Grant, K. E. Taylor, J. S. Ellis, and D. J. Wuebbles Jul. 1987 15 p
(Contract W-7405-eng-48)
(DE87-014320; UCID-21146) Avail: NTIS HC A03/MF A01

The authors have implemented a series of state of the art radiation transport submodels in previously developed one dimensional and two dimensional chemical transport models of the troposphere and stratosphere. These submodels provide the capability of calculating accurate solar and infrared heating rates. They are a firm basis for further radiation submodel development as well as for studying interactions between radiation and model dynamics under varying conditions of clear sky, clouds, and aerosols. DOE

N88-10442# Heidelberg Univ. (West Germany). Naturwissenschaftlich-Mathematischen Gesamfakultaet.
ION COMPOSITION MEASUREMENTS IN THE UPPER STRATOSPHERE Ph.D. Thesis [IONENKOMPOSITIONSMESSUNGEN IN DER OBEREN STRATOSPHAERE]
Klaus Pfeilsticker 1985 172 p In GERMAN
(ETN-87-90423) Avail: NTIS HC A08/MF A01

The natural ion composition in the stratopause region (40 to 60 km) was investigated using the parachute-borne mass spectrometer STRAFAM. The quadrupole spectrometer measuring method, the measuring flight, and the payload are described. The spectra of positive ions are discussed. The relative counting rates of proton hydrates, ion fragmentation, the fractional counting rates of the non-proton hydrates, and trace gas concentrations deduced from the positive ions were determined. The spectra of negative ions are discussed. The fractional counting rates of the negative ions, and the trace gas concentrations deduced from the negative ions were determined. The chemical evolution and composition of negative stratospheric ions were determined by simulation model calculations. ESA

N88-10443# Arizona Univ., Tucson. Dept. of Atmospheric Sciences.
AIRBORNE LIDAR STUDIES OF ARCTIC POLAR STRATOSPHERIC CLOUDS Ph.D. Thesis
Lamont Rozelle Poole 1987 235 p
Avail: NTIS HC A11/MF A01

Airborne lidar measurements of Arctic polar stratospheric clouds (PSC) in January 1984 and January 1986 are reported. The locales and altitudes of the clouds coincided in both years with very cold ambient temperatures. Enhancements in aerosol backscattering in excess of a factor of 100 were measured during the 1984 experiment at latitudes near the Pole where 50 mb temperatures approached the frost point. Depolarization in the backscattered signal was estimated as 30 to 40 percent, similar to that measured in cirrus clouds. Farther south, with 50 mb temperatures several degrees warmer, backscatter enhancement factors ranged from 20 to 30, and little or no depolarization was observed. Results similar to the latter were found during the 1986 experiment. The contrast in observations suggested the existence of distinct cloud growth regimes delineated by temperature. A theoretical model was developed which interposes a stage of nitric acid trihydrate deposition between the two stages of cloud formation and growth assumed in earlier models. The calculated temperature dependence of backscatter and extinction agreed well with experimentally observed values, except for small systematic error at the 30 mb level. A companion theoretical study of PSC formation at 70 mb in the Antarctic showed that about 80 and 30 percent of the nitric acid and water vapor supplies, respectively, may be sequestered in relatively large cloud particles at a temperature near 189 K. It is suggested that the PSCs may act as a sink for these stratospheric trace gases. Author

N88-10444*# International Council of Scientific Unions, Paris (France).
MIDDLE ATMOSPHERE PROGRAM: HANDBOOK FOR MAP, VOLUME 24
Belva Edwards, ed. May 1987 103 p
(NASA-CR-181451; NAS 1.26:181451) Avail: NTIS HC A06/MF A01; also available as HC from SCOSTEP Secretariat, Univ. of Illinois, 1406 W. Green Street, Urbana, Ill. 61801 CSCL 04A

This MAP handbook lists the MAP steering and standing committees. Also listed is the regional consultative group, the secretariat, study groups, projects, and national representatives. The major portion of the handbook is taken up with the listing of scientist members by country and the alphabetical index and addresses of scientists. E.R.

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N88-10445# Brookhaven National Lab., Upton, N. Y. Environmental Chemistry Div.
AQUEOUS-PHASE REACTIONS IN CLOUDS
Stephen E. Schwartz Aug. 1986 25 p Presented at the American Chemical Society Symposium on Acid Rain, New York, N.Y., 13-18 Apr. 1986 Submitted for publication

(Contract DE-AC02-76CH-00016)
(DE86-005249; BNL-38614; CONF-860425-15) Avail: NTIS HC A03/MF A01

Reaction of dissolved gases in clouds occurs by the sequence gas-phase diffusion, interfacial mass transport, and concurrent aqueous-phase diffusion and reaction. Information required for evaluation of rates of such reactions included fundamantal data such as equilibrium constants, gas solubilities, kinetic rate laws, dependence on pH and catalysts or inhibitors, diffusion coefficients, and mass-accommodation coefficients, and situational data such as pH and concentrations of reagents and other species influencing reaction rates, liquid-water content, drop size distribution, insulation, temperature. Rate evaluations indicate that aqueous-phase oxidation of S(IV) by H2O2 and O3 can be important for representative conditions. No important aqueous-phase reactions of nitrogen species were identified. Examination of microscale mass-transport rates indicates that mass transport only rarely limits the rate of in-cloud reaction for representative conditions. Field measurements and studies of reaction kinetics in authentic precipitation samples are consistent with rate evaluations.
Author

N88-10446# Utah Univ., Salt Lake City. Dept. of Meteorology.
CLOUD CLIMATOLOGY DERIVED FROM THE AFGWC (AIR FORCE GLOBAL WEATHER CENTRAL) 3D-NEPHANALYSIS FOR JANUARY AND JULY 1979 Technical Report, 15 Jan. 1986 - 15 Jan. 1987
Michael K. Griffin, Kuo-Nan Liou, and George Koenig 15 Jan. 1987 56 p
(Contract F19628-84-K-0040)
(AD-A183686; AFGL-TR-87-0122; SR-1) Avail: NTIS HC A04/MF A01 CSCL 04B

Cloud climatologies of the Northern Hemisphere have been developed utilizing the AFGWC 3D-Nephanalysis (3DNEPH) cloud data base for January and July 1979. The vertical resolution of the 3DNEPH was reduced from 15 layers to 3 low, middle, and high (LMH) cloud layers. The horizontal grid points were mapped to the Nimbus-7 ERB/STA LAT/LON grid system to facilitate data comparison. Valid analysis times (Greenwich) were converted to local times. Zonal average total cloudiness correlates well with observed large-scale features for both months. The 3DNEPH compares reasonably well with other climatologies in the zonal average case except near the poles in the wintertime hemisphere. In this region, the 3DNEPH analysis overestimates the amount of midlevel cloudiness. This is thought to be caused by a lack of surface observations in the polar region, which may result in the infrared cloud processor misinterpreting cold snow-covered surfaces as clouds. Hemispherical plots of LMH and total cloud fields on a monthly mean scale are also presented. GRA

N88-10447# European Space Agency, Paris (France).
EXPERIMENTAL STUDY AND MODELING OF THE PHYSICAL MECHANISMS OF THE GLIDING SPARK
S. Larigaldie Apr. 1987 294 p Transl. into ENGLISH of Etude Experimentale et Modelisation des Mecanismes Physiques de l'Etincelle Glissante (Chatillon, France, ONERA), 1986 Original language document announced as N87-20094
(ESA-TT-1029; ONERA-P-1986-1; ETN-87-90665) Avail: NTIS HC A13/MF A01

The fast propagation of an ionized and thermalized arc channel was studied in ambient air, using a device consisting of a gliding discharge produced at the upper surface of a dielectric slab charged by corona effect. The propagation velocity was 1 million m/sec, the density 10 to the 18th power /cc, and the temperature 28,000. The predetermined gliding spark path allows the use of a full set of diagnostics, including measurements of the current and the propagation velocity, recording of the light emission, optical study of the width of the arc channel by holographic interferometry, and detection of the transient electric field by capacitive probes. The experimental and theoretical analysis of the negative spark shows that the thermalized arc channel is produced in three stages; a predischarge stage similar to a glow discharge, a transient arc stage, and a heating stage where the ionization energy is partially restituted as heat to neutrals. The analogies between gliding sparks and atmospheric lightning are demonstrated. ESA

N88-10448# Royal Netherlands Meteorological Inst., De Bilt.
A 15 cm APERTURE LED SCINTILLOMETER FOR C(n) SQUARED AND CROSSWIND MEASUREMENTS
W. Kohsiek 1987 26 p
(KNMI-WR-87-3; B8709748; ISSN-0169-1651; ETN-87-90815)
Copyright Avail: NTIS HC A03/MF A01

An optical scintillometer to measure the refractive index structure parameter and the wind speed across the transmission path was built. The device uses a light emitting diode at 0.94 microns as a light source and simple semiconductor light detectors. Results on a test path of 449 m are good, despite scatter. ESA

N88-10449# Royal Netherlands Meteorological Inst., De Bilt.
A DEVICE FOR MEASURING FAST TEMPERATURE FLUCTUATIONS
W. Kohsiek 1987 21 p
(KNMI-TR-92; B8707546; ISSN-0169-1708; ETN-87-90818)
Copyright Avail: NTIS HC A03/MF A01

A platinium wire resistance temperature sensing unit capable of measuring temperature fluctuations with frequencies up to a few hundred Hz was developed. In micrometeorological research it enables the detection of small eddies with sizes down to the dissipation range. Thus, the device is particularly suitable for eddy correlation flux and temperature spectra measurements close to the Earth's surface. ESA

N88-10450# Pacific Northwest Labs., Richland, Wash.
DESCRIPTION OF THE MOUNTAIN CLOUD CHEMISTRY PROGRAM VERSION OF THE PLUVIUS MOD 5.0 REACTIVE STORM SIMULATION MODEL
D. J. Luecken, C. D. Whiteman, E. G. Chapman, G. L. Andrews, and D. C. Bader Jul. 1987 97 p
(Contract DE-AC06-76RL-01830)
(DE87-012846; PNL-6242) Avail: NTIS HC A05/MF A01

Damage to forest ecosystems on mountains in the eastern United States has prompted a study conducted for the US Environmental Protection Agency's Mountain Cloud Chemistry Program (MCCP). This study has led to the development of a numerical model called MCCP PLUVIUS, which has been used to investigate the chemical transformations and cloud droplet deposition in shallow, nonprecipitating orographic clouds. The MCCP PLUVIUS model was developed as a specialized version of the existing PLUVIUS MOD 5.0 reactive storm model. It is capable of simulating aerosol scavenging, nonreactive gas scavenging, aqueous phase SO2 reactions, and cloud water deposition. A description of the new model is provided along with information on model inputs and outputs, as well as suggestions for its further development. The MCCP PLUVIUS incorporates a new method to determine the depth of the layer of air which flows over a mountaintop to produce an orographic cloud event. It provides a new method for calculating hydrogen ion concentrations, and provides updated expressions and values for solubility, dissociation and reaction rate constants. DOE

N88-10451*# National Aeronautics and Space Administration, Washington, D.C.
ATLAS OF WIDE-FIELD-OF-VIEW OUTGOING LONGWAVE RADIATION DERIVED FROM NIMBUS 7 EARTH RADIATION BUDGET DATA SET - NOVEMBER 1978 TO OCTOBER 1985
T. Dale Bess and G. Louis Smith Aug. 1987 176 p
(NASA-RP-1186; L-16326; NAS 1.61:1186) Avail: NTIS HC A09/MF A01 CSCL 04B

An atlas of monthly mean outgoing longwave radiation global contour maps and associated spherical harmonic coefficients is presented. The atlas contains 84 months of continuous data from November 1978 to October 1985. The data were derived from the second Earth radiation budget experiment, which was flown on the Nimbus 7 Sun-synchronous satellite in 1978. This data set is a companion set and extension to a similar report of the Nimbus 6 satellite. Together these two reports give a data set covering a

10 year time period and will be very valuable in studying different aspects of our changing climate over monthly, annual, and interannual scales in the time domain and over regional, zonal, and global scales in the spatial domain. Author

N88-10452*# Electro Magnetic Applications, Inc., Denver, Colo.
THE PHYSICS OF CHARGE SEPARATION PRECEDING LIGHTNING STROKES IN THUNDERCLOUDS
Ali Kyrala (Arizona State Univ., Tempe.) Aug. 1987 19 p
(Contract NAS1-17748)
(NASA-CR-178371; NAS 1.26:178371; EMA-87-R-67) Avail: NTIS HC A03/MF A01 CSCL 04B

The physics of charge separation preceding lightning strokes in thunderclouds is presented by three types of arguments: An explanation is given for the aggregation of electrical charges of like sign overcoming Coulomb repulsion by attraction due to exchange interaction. The latter is well known in quantum mechanics from the theories of the nuclear bond and the covalent bond. A classical electrostatic model of charge balls of segregated positive and negative charges in the thundercloud is presented. These charge balls can only be maintained in temporarily stable locations by a containing vortex. Because they will be of different sizes and masses, they will stabilize at different altitudes when drag forces are included with the given electrostatic force. The question of how the charges become concentrated again after lightning discharges is approached by means of the collisional Boltzmann transport equation to explain quasi-periodic recharging. It is shown that solutions cannot be separable in both position and time if they are to represent aggregation. Author

N88-10453*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GOES OBSERVATIONS FOR THE FIRE/SRB WISCONSIN EXPERIMENT REGION FROM OCTOBER 11 THROUGH NOVEMBER 2, 1986
Charles H. Whitlock, Stuart R. LeCroy, and Eric J. Raitch (PRC Kentron, Inc., Hampton, Va.) Oct. 1987 80 p
(NASA-TM-100485; NAS 1.15:100485) Avail: NTIS HC A05/MF A01 CSCL 04B

A map, concise tables, and satellite images are presented which show ground-site locations, GOES visible/infrared instrument counts above each site, and cloud spatial distribution for the experiment region from 11 October through 2 November 1986. The cloud images are presented near times of the afternoon NOAA-9 satellite overpasses in order to provide a qualitative aid in the interpretation of TOVS, AVHRR, and heat budget data during the FIRE/SRB experiment. Author

N88-10454# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
ESTIMATION FROM SATELLITE IMAGERY OF SUMMERTIME RAINFALL OVER VARIED SPACE AND TIME SCALES
C. G. Griffith Apr. 1987 116 p
(PB87-203246; NOAA-TM-ERL-ESG-25) Avail: NTIS HC A06/MF A01 CSCL 04B

Rainfall estimates for the central United States, inferred from the thermal infrared channel of the Geostationary Operational Environmental Satellite (GOES) for August 1979, are compared with gage rainfalls over hourly and daily time frames. Area-averaged amounts are computed for the region 90.25 to 108.25 deg W and 30.5 to 45.75 deg N, which extends roughly from the Rocky Mountains to the Mississippi River and from the North Dakota-South Dakota border into central Texas, covering 3,600,000 sq km. Point values within this region are also compared. Estimates are made with two versions of the satellite technique. One incorporates cloud life cycle information derived from a sequence of images; the other uses area and temperature information from a single source. GRA

N88-10455# National Oceanic and Atmospheric Administration, Washington, D. C. Satellite Applications Lab.
TROPICAL CYCLONE CENTER LOCATIONS FROM ENHANCED INFRARED SATELLITE IMAGERY
J. Jiang and V. F. Dvorak May 1987 18 p Prepared in cooperation with National Meteorological Bureau, Beijing, China
(PB87-213450; NOAA-TM-NESDIS-18) Avail: NTIS HC A03/MF A01 CSCL 04B

A procedure to locate tropical cyclone centers with Enhanced Infrared (EIR) satellite imagery is presented. Schematic representations of cloud pattern centers are shown along with EIR examples to help the user select the most likely center position for any of six different cloud pattern categories. Differences between cyclone centers determined by aircraft reconnaissance fixes and those determined by using only EIR images are evaluated. These differences are then compared with the same kind of differences where the centers were operationally assigned by Miami SFSS meteorologists. The Miami SFSS meteorologists used both visible and infrared satellite images, as well as past storm track positions. Results show that the Miami SFSS procedure made better estimates of center location. GRA

N88-10456# Pacific Northwest Labs., Richland, Wash.
HANFORD METEOROLOGICAL STATION COMPUTER CODES. VOLUME 1: THE GEN COMPUTER CODE
J. W. Buck and G. L. Andrews Jul. 1987 33 p
(Contract DE-AC06-76RL-01830)
(DE87-012816; PNL-6279-Vol-1) Avail: NTIS HC A03/MF A01

The Hanford Meteorological Station, operated by Pacific Northwest Laboratory, issues general weather forecasts twice a day. The GEN computer code is used to archive the 24-hour forecasts and apply quality assurance checks to the forecast data. This code accesses an input file, which contains the date and hour of the previous forecast, and an output file, which contains 24-hour forecasts for the current month. As part of the program, a data entry form consisting of 14 fields that describe various weather conditions must be filled in. The information on the form is appended to the current 24-hour monthly forecast file, which provides an archive for the 24-hour general weather forecasts. This report consists of several volumes documenting the various computer codes used at the Hanford Meteorological Station. This volume describes the implementation and operation of the GEN computer code at the station. DOE

N88-10457# East Anglia Univ., Norwich (England). Climatic Research Unit.
DETECTION OF CO2-INDUCED CLIMATE CHANGE Progress Report, 16 Jul. 1986 - 15 Jul. 1987
T. M. L. Wigley and P. D. Jones Jul. 1987 18 p
(Contract DE-FG02-86ER-60397)
(DE87-013127; DOE/ER-60397/T1) Avail: NTIS HC A03/MF A01

Progress in the following areas is reported: (1) Southern Hemisphere temperature data; (2) updating of gridded land-based surface air temperature data sets for both hemispheres; (3) use of satellite data in estimating monthly mean surface air temperatures; (4) comparison of UKMO and COADS marine temperature data sets; (5) amalgamation of land and marine (UKMO) temperature data sets; (6) analysis of gridded mean sea level pressure data; (7) regional validation of general circulation models; and (8) detection studies. DOE

N88-10458# East Anglia Univ., Norwich (England).
TESTIMONY TO THE US SENATE ON THE GREENHOUSE EFFECT
T. M. L. Wigley 1987 10 p
(Contract DE-FG02-86ER-60397)
(DE87-013995; DOE/ER-60397/T2) Avail: NTIS HC A02/MF A01

This testimony was presented on January 28, 1987 at the hearing on, The Greenhouse Effect, Climate Change and Ozone Depletion, United States Senate Committee on Environment and Public Works, Subcommittee on Environmental Protection and Subcommittee on Hazardous Wastes and Toxic Substances. The testimony concerns the observed global warming that has occurred over the past 100 years. How this temperature record was obtained is summarized and the details of the record described, with

particular reference to the most recent decades and to the differences between the records for Northern and Southern Hemispheres. The record is compared with the predicted warming over the same period due to the effects of increasing greenhouse gas concentrations in the atmosphere. The projected warming over the next 70 years is compared with global temperature changes that have occurred over the past few million years. DOE

N88-10459# Oak Ridge National Lab., Tenn.
MASTER INDEX FOR THE CARBON DIOXIDE RESEARCH STATE-OF-THE-ART REPORT SERIES
M. P. Farrell, ed. Mar. 1987 258 p
(DE87-012757; DOE/ER-0316) Avail: NTIS HC A12/MF A01

Four State of the Art (SOA) reports, Atmospheric Carbon Dioxide and the Global Carbon Cycle, Direct Effects of Increasing Carbon Dioxide on Vegetation, Detecting the Climatic Effects of Increasing Carbon Dioxide, and Projecting the Climatic Effects of Increasing Carbon Dioxide, and two companion reports, Characterization of Information Requirements for Studies of CO2 Effects: Water Resources, Agriculture, Fisheries, Forests and Human Health and Glaciers, Ice Sheets, and Sea Level: Effect of a CO2-Induced Climatic Change, were published by the US Department of Energy's Carbon Dioxide Research Division. Considerable information on atmospheric carbon dioxide and its possible effects on world climate is summarized in these six volumes. Each volume has its own index, but to make the information that is distributed throughout the six volumes more accessible and usable, comprehensive citation and subject indexes have been compiled. The subject indexes of the individual volumes have been edited to provide a uniformity from volume to volume and also to draw distinctions not needed in the separate volumes' indexes. Also, the comprehensive subject index has been formatted in a matrix arrangement to graphically show the distribution of subject treatment from volume to volume. Other aids include cross references between the scientific and common names of the animals and plants referred to, a glossary of special terms used, tables of data and conversion factors related to the data, and explanations of the acronyms and initialisms used in the texts of the six volumes. The executive summaries of the six volumes are collected and reproduced to allow the readers interested in the contents of one volume to rapidly gain information on the contents of the other volumes. DOE

N88-10460# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONCEPTION AND DISCUSSION OF A MODEL DESCRIBING ICE FORMATION ON VARIOUS OBSTACLES Ph.D. Thesis - Clermont-Ferrand Univ., France
Luc Brunet 1986 100 p In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-1086)
(ONERA-NT-1986-6; ISSN-0078-3781; ETN-87-90648) Avail: NTIS HC A05/MF A01

A development of the Bain-Lozowski ice formation model is presented. It takes into account the ice density in the local thickness of the deposit and investigates the aerodynamic and thermal aspects of the problem. The numerical model was tested in the wind tunnel. The validity is confirmed, showing the capability to predict the arrowhead ice forms commonly obtained for long exposure times. ESA

N88-10461*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYSIS OF THE BIVARIATE PARAMETER WIND DIFFERENCES BETWEEN JIMSPHERE AND WINDSONDE
Michael Susko Sep. 1987 81 p
(NASA-TM-4014; NAS 1.15:4014) Avail: NTIS HC A05/MF A01 CSCL 04B

An analysis is presented for the bivariate parameter differences between the FPS-16 Radar/Jimsphere and the Meteorological Sounding System (MSS) Windsonde. The Jimsphere is used as the standard to measure the ascent wind during the Space Shuttle launches at Kennedy Space Center, Florida, and the Windsonde is the backup system. In addition, a discussion of the terrestrial environment (below 20 km) and a description of the Jimsphere and Windsonde wind sensors are given. Computation of the wind statistics from 64 paired Jimsphere and Windsonde balloon releases in support of 14 Space Shuttle launches shows a good agreement between the two wind sensors. From the analysis of buildup and back-off data for various scales of distance and the comparison of the cumulative percent frequency (CPF) versus wind speed change, it is shown that the wind speed change for various scales of distances for the Jimsphere and Windsonde compare favorably. Author

N88-10462# National Center for Atmospheric Research, Boulder, Colo.
DESCRIPTION OF NCAR (NATIONAL CENTER FOR ATMOSPHERIC RESEARCH) COMMUNITY CLIMATE MODEL (CCM1)
D. L. Williamson, J. T. Kiehl, V. Ramanathan, R. E. Dickinson, and J. J. Hack Jun. 1987 117 p
(Grant NSF ATM-82-17015)
(PB87-203782; NCAR/TN-285-STR) Avail: NTIS HC A06/MF A01 CSCL 04B

The details of the governing equations, physical parameterizations, and numerical algorithms defining the version of the National Center for Atmospheric Research (NCAR) Community Climate Model designated CCM1 are presented. The presentation is designed to follow the flow of the model code, but it does not provide details of the code itself. Such details are given in separate reports described later in this document. It is NCAR's intention that this model provide NCAR and the university research community with a general circulation model with strong emphasis on documentation and reliability. The CCM1 version has evolved over the last few years from the earlier CCMO. GRA

N88-10463# Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
CONTRIBUTIONS TO THE MODELING OF WIND SHEAR FOR DANGER STUDIES Ph.D. Thesis [BEITRAEGE ZUR MODELLIERUNG VON SCHERWIND FUER GEFAEHRDUNGSUNTERSUCHUNGEN]
Manfred Swolinsky 1986 202 p In GERMAN
(ETN-87-90442) Avail: NTIS HC A10/MF A01

Wind models for flight simulation and the study of the danger during landing due to wind shear were developed. It is demonstrated that the typical wind conditions in weather phenomena such as thunderstorm fall winds and surface boundary layer wind shear can be approximated by simple engineering models, whereby known solutions and flow forms from flow mechanics were adapted. The good agreement between models and airborne measurements is demonstrated. Based on the developed models the degree of danger during landing under different wind shear conditions was estimated. ESA

N88-10464# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Wolkenphysik.
THE DEPENDENCE OF THE NORMALIZED ICE ACCRETION THICKNESS ON CLOUD-PHYSICAL PARAMETERS
Hans-Eberhard Hoffmann, Roland Roth, and Johann Demmel Jan. 1987 64 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-1080)
(DFVLR-FB-87-08; ISSN-0171-1342; ETN-87-90455) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 24.50

Normalized ice accretion thickness was studied using the measurement results of 38 icing research aircraft flights in icing clouds. Normalized ice accretion is the ice accretion thickness on 3 metal cylinders in flow direction, for a true air speed of 125 kt, and a flight path in clouds of 10 NM (i.e., 18.5 km). In the investigated range of liquid water content up to 0.50 g/cum, the normalized ice thickness grows linearly with increasing liquid water content; it is a little larger for cloud particles freezing instantaneously. The thickness is larger for smaller cylinder diameters. In the temperature range between minus 2 and minus

14 C, a difference in temperature has only a little influence, differences in particle phase and particle size distribution have no influence on the normalized ice accretion thickness. ESA

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N88-10465# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
GEOACOUSTIC MODELS OF THE HUDSON CANYON AREA Final Report
C. E. Sellinger and D. L. Lavoie Jan. 1987 14 p
(AD-A183535; NORDA-161) Avail: NTIS HC A03/MF A01 CSCL 20A

To better understand the interaction of sound wave propagation with the sea floor, three geographic sites were selected for modeling. These sites composed a region that begins at a water depth of 75 m and continues to approximately 5050 m. Surficial sediments range from a sand-silt-clay fluvial deposit on the shelf to a red clay and a clay-sized calcareous ooze. Structural features, such as the Hudson Canyon area, the Hatteras Outer Ridge, a lower Cretaceous carbonate reef, and a deep structural basin, play a strong historical role in shaping the sediment distribution and topography in this region. Several prominent horizons, are identified using graphically descriptive profiles. Three geoacoustic models of each site were developed using Hamilton's techniques. These models provide depth to horizons, compressional wave velocities, shear wave velocities, densities, and attenuation of the individual sediment type. GRA

N88-10466# Office of Naval Research, Arlington, Va.
SATELLITE AND SYNOPTIC STUDIES OF CHEMICAL FRONTS IN THE CALIFORNIA CURRENT AND COASTAL UPWELLING ZONE Final Technical Report
Eugene D. Traganza 31 May 1987 40 p
(Contract N00014-85-K-0054)
(AD-A183909) Avail: NTIS HC A03/MF A01 CSCL 08C

A number of at sea experiments were conducted to investigate the significance of chemical fronts as sites of chemical exchange and primary production. Satellite IR images were used to detect upwelling systems and to predict the subsurface chemical structure of fronts from the surface thermal pattern. Surface jets (giant plumes) were discovered along with distinctively structured eddy-like features which were named cyclonic upwelling systems. GRA

N88-10467# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
CONTRIBUTION OF BUBBLES AND WAVES TO AIR-SEA CO2 FLUX, WITH IMPLICATIONS FOR REMOTE SENSING
G. B. Crawford Apr. 1987 33 p
(PB87-203980; NOAA-TM-ERL-WPL-145) Avail: NTIS HC A03/MF A01 CSCL 08C

The concepts behind the simple one-dimensional models for gas transfer are described and the important parameters are defined. Two models for gas transport through bubbles are discussed, and relevant laboratory and field measurements are presented. The importance of the wave field is also discussed. The report concludes with a summary of the current state of understanding of the air-sea gas exchange and the implications for remote sensing of carbon dioxide flux. GRA

N88-10468*# Columbia Univ., New York, N.Y.
THE EFFECT OF WIND AND CURRENTS ON GAS EXCHANGE IN AN ESTUARINE SYSTEM Final Technical Report, 1 Aug. 1986 - 31 Jul. 1987
W. S. Broecker, J. R. Ledwell, and R. Bopp 2 Nov. 1987 11 p
(Grant NAGw-667)
(NASA-CR-181424; NAS 1.26:181424) Avail: NTIS HC A03/MF A01 CSCL 08C

The objectives were to develop a non-volatile tracer to use in gas exchange experiments in laterally unconfined systems and to study applications of deliberate tracers in limnology and oceanography. Progress was made on both fronts but work on the development of the non-volatile tracer proved to be more difficult and labor intensive that anticipated so no field experiments using non-volatile tracers was performed as yet. In the search for a suitable non-volatile tracer for an ocean scale gas exchange experiment a tracer was discovered which does not have the required sensitivity for a large scale experiment, but is very easy to analyze and will be well suited for smaller experiments such as gas exchange determinations on rivers and streams. Sulfur hexafluoride, SF6, was used successfully as a volatile tracer along with tritium as a non-volatile tracer to study gas exchange rates from a primary stream. This is the first gas exchange experiment in which gas exchange rates were determined on a head water stream where significant groundwater input occurs along the reach. In conjunction with SF6, Radon-222 measurements were performed on the groundwater and in the stream. The feasibility of using a combination of SF6 and radon is being studied to determine groundwater inputs and gas exchange of rates in streams with significant groundwater input without using a non-volatile tracer. Author

51 LIFE SCIENCES (GENERAL)

N88-10469# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Hauptabteilung Projekte und Mikrogravitation.
AQUARACK: AIMS AND POSSIBLE RESEARCH PROJECTS
Dec. 1986 97 p In GERMAN; ENGLISH summary Lectures presented at the Aquarack Workshop, Cologne, West Germany, 6 Jun. 1986 Report will also be announced as translation (ESA-TT-1083)
(DFVLR-Mitt-87-01; ISSN-0176-7739; ETN-87-90445) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The research possibilities offered by the long term maintenance system for aquatic organisms, Aquarack, are discussed. The reproduction biology of the genus Xiphophorus was investigated. The Xiphophorus system and its possible applications for biological studies in a microgravity environment were examined. Long term investigations of the growth, metabolism, and reproduction of fish under conditions close to weightlessness are proposed. The functional plasticity of the nervous system of vertebrates was investigated. The influence of weightlessness on behavior, reproduction, and metabolism of the freshwater snail Biomphalaria glabrata was studied. The usefulness of microalgal structures as an element of closed ecological systems is discussed. The state of the art of space life support systems for biological experiments under weightlessness is surveyed. For individual titles, see N88-10470 through N88-10477.

N88-10470# Ruhr Univ., Bochum (West Germany). Fakultaet fuer Biologie.
THE AQUARACK AS A POTENTIAL INSTRUMENT FOR BASIC RESEARCH WORK IN SPACE BIOLOGY: INVENTORY AND SCIENTIFIC DISPOSITIONS
Volker Bluem *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 9-18 In GERMAN; ENGLISH summary
(For primary document see N88-10469 01-51)
Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The research possibilities offered by the prototype of a long-term maintenance system for aquatic organisms, Aquarack, are discussed. The construction principles of the Aquarack are described. Three possible levels of scientific work are outlined. The first includes the construction of a prototype and its testing

using methods of reproductive and metabolic physiology. The second contains the space-adapted final version within a spacelab and its examinations using developed methods. The last level involves a series of special projects with high scientific value, provided by different users. ESA

N88-10471# Ruhr Univ., Bochum (West Germany). Fakultaet fuer Biologie.

INVESTIGATIONS OF THE SURVEY OF THE REPRODUCTIVE BIOLOGY OF XIPHOPHORUS IN AN AQUARACK

Volker Bluem and Ruediger Schulz *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 19-27 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The reproduction biology of the genus Xiphophorus was investigated in the long term maintenance system Aquarack. The availability of a long term maintenance system and a successful reproduction in this system are discussed as prerequisites for biological science and for application-oriented research, dealing with boney fish in consecutive generations in a microgravity environment. The particular suitability of the genus Xiphophorus as experimental animal is explained, and the most important endocrine system regulating reproduction is outlined. ESA

N88-10472# Giessen Univ. (West Germany). Inst. fuer Genetische.

XIPHOPHORUS AS AN EXPERIMENTAL SYSTEM FOR GENETIC AND BIOLOGICAL DEVELOPMENT STUDIES UNDER MICROGRAVITY CONDITIONS [XIPHOPHORUS ALS MODELLSYSTEM FUER GENETISCHE UND ENTWICKLUNGSBIOLOGISCHE UNTERSUCHUNGEN IN DER 0-G-UMWELT]

Markus Schmidt and Fritz Andres *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 29-36 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The Xiphophorus system and its possible applications for biological studies in a microgravity environment were examined. By selective intra and interspecific crossing and backcrossings of wild types and mutants of Xiphophorus, an experimental system of 60 different, defined genotypes was constructed. Among these are strains that specifically react by neoplastic transformation after the application of mutagens and differentiation promotors. This and the comprehensive characterization of the system allow a large number of experiments in a space mission to examine the influence of cosmic radiation and weightlessness on genetics, physiology, development, morphology, histology, and cytology of the fish. ESA

N88-10473# Kiel Univ. (West Germany). Inst. fuer Meereskunde.

LONG TERM INVESTIGATIONS OF THE GROWTH, METABOLISM, AND REPRODUCTION OF FISH UNDER CONDITIONS CLOSE TO WEIGHTLESSNESS

Rainer Froese *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 37-45 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The investigation of growth, metabolism, and reproduction of several generations of fish of the genus Xiphophorus, in a future space station, is proposed. The different subjects to be investigated are outlined. The proposed materials and methods are presented. The data are planned to be collected indirectly, i.e., by video cameras and photoelectric cells. Cooperation with other research projects is planned. Findings for the development of closed ecological life support systems are expected. ESA

N88-10474# Stuttgart Univ. (West Germany). Inst. fuer Zoologie.

FUNCTIONAL PLASTICITY OF THE NERVOUS SYSTEM OF VERTEBRATES

Hinrich Rahmann and Wolfgang Probst *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 47-59 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The development, behavior, and adaptability of the central nervous system (CNS) of fishes, especially the tectum opticum, were investigated using optical and electron microscopes, as well as biochemical methods. Following light versus dark rearing, and adaptation to the cold versus warmth, an ultra structural neuronal plasticity is observed, especially concerning the sites of synapses. Synapses with different activity can be determined by different enrichments of extracellular calcium in the synaptic cleft and by the ultracytochemical observation of the activity of the doubly-ionized-Ca-ion-ATPase in the CNS. Using such ultra structural parameters, the influence of microgravity on the structure and function-related neuronal plasticity of the CNS of vertebrates can be investigated during the early ontogenetic development as well as in the adult state. ESA

N88-10475# Hamburg Univ. (West Germany). Inst. fuer Zoologie.

THE INFLUENCE OF WEIGHTLESSNESS ON THE METABOLISM OF THE BIOMPHALARIA GLABRATA

Wilhelm Becker *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 61-68 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The influence of weightlessness on behavior, reproduction, and metabolism of the freshwater snail Biomphalaria glabrata (Pulmonata) was investigated. A method for the continuous recording of heartbeat frequency and heart minute volume in the uninjured animal was developed and successfully tested under gravity conditions. The results are planned to be used to determine the effect of the gravitational force on the open circulatory system of this snail. ESA

N88-10476# Bonn Univ. (West Germany). Inst. fuer Botanie.

THE USEFULNESS OF MICROALGAL STRUCTURES AS AN ELEMENT OF CLOSED ECOLOGICAL SYSTEMS LIKE AQUARACK AND CELSS

Karlheinz Kreuzberg *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 69-76 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The usefulness of continuous cultures of green algae, such as Scenedesmus, Chlorella, Chlamydomonas, and Chlorogonium, was examined with respect to the regeneration of oxygen and the reassimilation of CO2 and ammonia. The most important advantages of microalgal cultures are a low demand of space, controlled and selfregulated cell growth, high metabolism rates, efficient energy transfer, a well balanced carbon and nitrogen recovery, and suitability for human food. Further investigations for the development of a practicable algal module for closed ecological systems are proposed. ESA

N88-10477# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

LIFE SUPPORT SYSTEMS FOR BIOLOGICAL EXPERIMENTS UNDER WEIGHTLESSNESS IN THE GERMAN AND EUROPEAN SPACE PROGRAMS

Wolfram Lork and Rainer Stoepler *In* DFVLR, Aquarack: Aims and Possible Research Projects Dec. 1986 p 77-93 In GERMAN; ENGLISH summary (For primary document see N88-10469 01-51)

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 33.50

The state of the art of space life support systems is surveyed. The tendency to the development of closed loop systems is emphasized. The configuration of several life support systems, such as the Spacelab Environmental Control and Life Support System, biorack and biological incubators, a botany facility and solar plant growth facility, a fish incubator, the Environmental Life Support System and Biological Life Support System, the Controlled Ecological Life Support Systems, and Aquarack, is described. Proposals for further research are given. ESA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N88-10478# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Thermal Physiology Group.
DETERMINATION OF THE INDIVIDUAL STATE OF ACCLIMATIZATION
G. Havenith and H. vanMiddendorp Oct. 1986 23 p
(IZF-1986-27; TD-86-4548; ETN-87-90858) Avail: NTIS HC A03/MF A01

A subject's state of acclimatization was defined in terms of sweat rate, core temperature, and heart rate to a heat stress test. The overall effect of acclimatization is similar to results in the literature; lower heart rate, higher sweat sensitivity, lower core temperature. Individual effects, however, are more difficult to interpret. Qualitatively, they all show the mentioned changes, but comparing their individual physiological reactions, differences are observed. Ranking orders for their acclimatization state, based on heart rate response, are different from those based on core temperature and sweat rate-core temperature relation responses. It appears that the heart rate, core temperature and sweat rate-core temperature relations are correlated to the acclimatization state, whereas the heart-rate response is also strongly influenced by fitness level. ESA

N88-10479# Oak Ridge National Lab., Tenn.
RADIATION EFFECTS IN SPACE
R. J. M. Fry Jul. 1987 6 p Presented at the 8th International Congress of Radiation Research, Edinburgh, Scotland, 19 Jul. 1987
(Contract DE-AC05-84OR-21400)
(DE87-012529; CONF-870701-3) Avail: NTIS HC A02/MF A01

As more people spend more time in space, and the return to the Moon and exploratory missions are considered, the risks require continuing examination. The effects of microgravity and radiation are two potential risks in space. These risks increase with increasing mission duration. This document considers the risk of radiation effects in space workers and explorers. DOE

N88-10480# California Univ., Berkeley. Lawrence Berkeley Lab.
LOCAL HUMAN SKIN POTENTIAL: SPATIAL DISTRIBUTION, MAGNITUDE AND ORIGIN Ph.D. Thesis
C. Cullander Apr. 1987 174 p
(Contract DE-AC03-76SF-00098)
(DE87-012882; LBL-23450) Avail: NTIS HC A08/MF A01

The sources and distribution of the slowly varying electric potential across hairy skin and the spatial distribution of the eccrine gland pores, which may be related to the skin potential, are investigated. The transdermal electrical potential in the same area on the back of the hands of eight subjects was measured under experimental conditions designed to minimize eccrine gland activity. The mean potential over all subjects was 24.86 +/- 8.16 mV. The pore distribution was evaluated by transferring the imprint of pilocarpine-stimulated gland secretions on special paper to digitized arrays. The average gland count over all records for the mean electrode radius (1 mm) was 9.09 +/- 3.55 glands. The correlation between the measured potential and the number of glands at each measurement site was calculated, and in general, the measured potential was independent of gland count. This lack of correlation was consistent with an equivalent circuit model for non-sudorific potential generation. This model predicted a minimal contribution from the passive glands and the existence of at least one other source of potential. One such source is regional variability in the permeability barrier of the skin. The pore arrays were also used to make a spectral analysis of the spatial frequencies present in the point pattern. Radial profiles of the power spectra and autocorrelation estimates demonstrated that the inter-pore distance is nearly constant (0.49 +/- 0.043 mm). The larger scale periodicity of 1.84 +/- 0.35 mm is related to the absence of glands surrounding hair follicles. Simulations of gland distributions by a stochastic model were used to verify the uniqueness of the findings. DOE

N88-10481# Stockholm Univ. (Sweden). Inst. of Physics.
FAST DYNAMIC STUDIES WITH PC384-7B; SYSTEM IMPROVEMENTS AND DEVELOPMENT OF AN AUTOMATED BLOOD SAMPLING SYSTEM
L. Eriksson, M. Mosskin, Chr. Bohm, M. Kesselberg, B. Hovander, and S. Holte Apr. 1987 23 p
(USIP-87-05; ETN-87-90749) Avail: NTIS HC A03/MF A01

An improvement in a positron emission tomography camera system, reducing the dead time, was implemented. An automated blood sampling system was constructed and evaluated. Two different detector units in the blood sampling system are compared. Results from regional cerebral blood flow studies are discussed. ESA

N88-10482# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
DETECTION OF HYPERVENTILATION OF PARACHUTISTS Ph.D. Thesis - Technische Univ., Hanover, West Germany
Hans-Dietrich Melzig Feb. 1987 125 p In GERMAN; ENGLISH summary
(DFVLR-FB-87-11; ISSN-0171-1342; ETN-87-90458) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany DM 42.50

The experimental verification of parachutist hyperventilation and its possible effect on the nonopening of the parachute were investigated. The breathing gas contents and volumes of 100 parachutists were measured. Significant reductions of assimilated oxygen and carbon dioxide are recorded. Thus, a possible hypocapnia (reduced blood carbon dioxide) is demonstrated, especially during the critical jump phase (jump-freefall-canopy opening). As a consequence, the effect of hyperventilation has to be taken into account in parachutist accidents. Preventive measures during the medical examination have to be established, including a briefing. ESA

N88-10483*# Texas Univ., Houston. Health Science Center.
PREVENTION OF DISUSE OSTEOPOROSIS: EFFECT OF SODIUM FLUORIDE DURING FIVE WEEKS OF BED REST Final Report
Victor S. Schneider Oct. 1987 64 p
(Contract NAS9-16688)
(NASA-CR-172018; NAS 1.26:172018) Avail: NTIS HC A04/MF A01 CSCL 06E

An attempt was made to modify factors which promote disuse osteoporosis and thereby prevent it from occurring. Since fluoride is currently used to enhance bone formation in the treatment of low turnover osteoporosis, it was hypothesized that if the fluoride ion was available over a long period of time that it would slow the demonstrated loss of calcium by inhibiting bone resorption and enhancing bone formation. This study was used to determine whether oral medication with sodium F will modify or prevent 5 weeks of bed rest induced disuse osteoporosis, to determine the longitudinal effects of 5 weeks of bed rest on PTH, CT and calcitriol, to measure muscle volume changes and metabolic activity by magnetic resonance imaging and magnetic resonance spectroscopy during prolonged bed rest, to measure changes in

peak muscle strength and fatigability, and to measure bone turnover in bone biopsies. Subjects were studied during 1 week of equilibration, 4 weeks of control ambulation, 5 weeks of bed rest, and 1 week of reambulation. E.R.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N88-10484# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
MODELING OF HUMAN JUDGEMENT IN MULTICRITERIA ANALYSIS USING PAIRWISE COMPARISON [MODELISATION DU JUGEMENT HUMAIN DANS L'ANALYSE MULTICRITERE AU MOYEN DE COMPARAISONS PAR PAIRES]
F. A. Lootsma 1987 22 p In FRENCH Presented at Laboratoire d'Analyse et Modelisation de Systemes pour l'Aide a la Decision Conference, Paris, France, 9 Dec. 1986
(Rept-87-01; B8703782; ISSN-0920-2358; ETN-87-90834)
Copyright Avail: NTIS HC A03/MF A01

A class of discrete geometrical scales to express degree of judgement (indifferent, weak preference, preference, etc.) when comparing one stimulus with another is discussed. Fuzzy numbers are used to express preferential judgements, given the vagueness of the degrees and the imprecision of the decision makers. Only numbers with a triangular characteristic function are used since the parameters follow a transparent algebra. In a simplified model in which all the judgements are equally imprecise, an analytical solution which enables the propagation of fuzziness in a hierarchy of decision levels to be studied is obtained. ESA

N88-10485# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Vision Group.
MASKING EFFECTS OF FINE AND COARSE GRAIN PICTORIAL NOISE
A. vanMeeteren and J. M. Valeton Oct. 1985 38 p
(Grant AFOSR-0334)
(IZF-1985-21; TDCK-93624; ETN-87-90856) Avail: NTIS HC A03/MF A01

In order to evaluate the potential gain of noise suppression techniques, visual detection of sine wave gratings in images with fine and coarse grain pictorial noise was investigated. Threshold modulations were measured psychophysically as a function of spatial frequency. An important part of the threshold elevations caused by pictorial noise can be explained as masking by same spatial frequency components in the noise. This masking effect can be reduced by intelligent image processing according as a-priori knowledge of signal and noise is available. The fraction of information utilized can possibly be increased from 10% to nearly 100%. The detection of lower spatial frequencies can be moderately improved by blurring of the image, whereas, the detection of higher spatial frequencies can be improved by differentiation of the image. ESA

N88-10486# Royal Signals and Radar Establishment, Malvern (England).
A STUDY OF THE PERFORMANCE OF AUTOMATIC SPEECH RECOGNISERS WITH SPEECH IMPAIRED CHILDREN
D. C. Smith and M. J. Russell Apr. 1987 32 p
(RSRE-MEMO-4040; BR102763; ETN-87-90980) Copyright
Avail: NTIS HC A03/MF A01

The feasibility of using automatic speech recognition devices with speech impaired children was assessed, using five children with various speech and language problems. Structured conversations between a speech therapist and individual children were recorded in an informal play setting at the children's school. Two children with reasonably normal speech were also recorded. The recordings were preprocessed, edited and annotated. Isolated word recognition experiments were performed using computer simulation. Results suggest that speech recognition techniques are not sufficiently powerful to accommodate the degree of variability which occurs in the speech of children with the types of speech impairment considered. ESA

N88-10487# Royal Signals and Radar Establishment, Malvern (England).
PSYCHOPHYSICAL CONSIDERATIONS IN MEASURING MRTD WITH STARING ARRAYS
K. St. J. Murphy May 1987 13 p
(RSRE-MEMO-4031; BR102762; ETN-87-90981) Copyright
Avail: NTIS HC A03/MF A01

Large variations in minimum resolvable temperature difference (MRTD) data are partly attributed to inconsistent observer response biases. Psychophysical techniques which can minimize the errors introduced by such observer response bias are described. The techniques are applied to measurements of MRTD performance for staring array thermal imagers. ESA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N88-10488# Aviation Systems Concept, Inc., Annandale, Va.
REPORT OF SAFETY SURVEY: HUMAN INTEGRATION OF APPROACH CHARTS Final Report
William J. Cox and C. W. 'Bill' Connor May 1987 197 p
Prepared in cooperation with Midwest Systems Research, Inc., Dayton, Ohio
(Contract F33615-85-C-3623)
(DOT/FAA/PM-87/15) Avail: NTIS HC A09/MF A01

Results of a safety survey conducted among pilots associated with the USAF and civil flight operations are presented. The objective of the survey was to determine the scope of a previously identified safety issue: The need to establish formal human performance criteria for the development and evaluation of instrument approach procedures and charts. A total of 1,037 (of 6,000) survey forms were completed by pilots and returned for a review of the answers and volunteered comments to 30 survey questions. These questions related to these terminal instrument flight procedures and charting topics: information requirements; terrain and obstruction; runway information requirements; arrival and departure navigation procedures requirements; information location, symbology, and packaging. The study provides 6 recommendations which address several needs. These recommendations are listed and briefly discussed. Author

N88-10489# British Aerospace Public Ltd. Co., Stevenage (England). Space and Communications Div.
TELEOPERATION AND CONTROL STUDY Final Report
J. S. Sheppard, comp. Paris, France ESA Nov. 1986 556 p
(Contract ESA-6118/84)
(BAe-TP-8268; ESA-CR(P)-2413; ETN-87-90549) Copyright
Avail: NTIS HC A24/MF A01

Requirements for a servicing manipulator teleoperator system were derived using two mission model scenarios. The first scenario introduces the problem of communication time delays within the overall manipulator teleoperator control system, associated with the human operator being located on the ground while controlling a manipulator on a free-flying servicing vehicle, servicing a payload on a platform or satellite docked to it, in low Earth orbit. The second scenario has the human operator located on the shuttle aft deck controlling a manipulator servicing a payload in the cargo area. This scenario is intended to demonstrate the operational capability of the service manipulator system using the Robotic Servicing Experiment. A ground based supervisor is also assumed for this mission, permitting a teleoperation-control experiment with time delay, to be performed as required. It is concluded that true

teleoperation and control of a remote manipulator cannot be readily achieved in the presence of a communications time delay. ESA

N88-10490# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Thermal Physiology Group.
LOSS OF PERFORMANCE DUE TO MILITARY CLOTHING AND EQUIPMENT
W. A. Lotens Jul. 1986 32 p
(Contract A83/KL/105)
(IZF-1986-13; TD-86-3296; ETN-87-90857) Avail: NTIS HC A03/MF A01

Clothing and equipment effects on physical performance were assessed in coordination tests, sprinting and running, as well as handgrenade throwing and obstacle course. Average loss of performance is 0% to 2% for fatigues, insulative liner and helmet; 4% to 6% for outer garment, combat boots, chemical warfare CW-suit, CW-overboots, and respirator; and 7% and 13.5% for weapon carrying and fighting order (webbing with entrenching tool, canteen, rucksack and respirator in bag) respectively. The figures vary between statistically significant and very significant. Few interactions are significant. Both CW-gear with respirator and fighting order with weapon tend to regressive interaction. A model for the prediction of the loss of performance when combining items is presented. ESA

N88-10491*# Signal Research Center, Inc., Des Plaines, Ill.
CATALYTIC PROCESSES FOR SPACE STATION WASTE CONVERSION Final Report, 1 Oct. 1985 - 31 Jul. 1986
M. W. Schoonover and R. A. Madsen (AiResearch Mfg. Co., Torrance, Calif.) Jul. 1986 43 p
(Contract NAS2-12265)
(NASA-CR-177423; NAS 1.26:177423) Avail: NTIS HC A03/MF A01 CSCL 06K

Catalytic techniques for processing waste products onboard space vehicles were evaluated. The goal of the study was the conversion of waste to carbon, wash water, oxygen and nitrogen. However, the ultimate goal is conversion to plant nutrients and other materials useful in closure of an ecological life support system for extended planetary missions. The resulting process studied involves hydrolysis at 250 C and 600 psia to break down and compact cellulose material, distillation at 100 C to remove water, coking at 450 C and atmospheric pressure, and catalytic oxidation at 450 to 600 C and atmospheric pressure. Tests were conducted with a model waste to characterize the hydrolysis and coking processes. An oxidizer reactor was sized based on automotive catalytic conversion experience. Products obtained from the hydrolysis and coking steps included a solid residue, gases, water condensate streams, and a volatile coker oil. Based on the data obtained, sufficient component sizing was performed to make a preliminary comparison of the catalytic technique with oxidation for processing waste for a six-man spacecraft. Wet oxidation seems to be the preferred technique from the standpoint of both component simplicity and power consumption. Author

N88-10492# Oak Ridge National Lab., Tenn.
A METHODOLOGY FOR DYNAMIC TASK ALLOCATION IN A MAN-MACHINE SYSTEM
L. E. Parker and F. G. Pin 1987 20 p Presented at the 2nd International Symposium on Methodologies for Intelligent Systems, Charlotte, N.C., 14 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE87-007373; CONF-871043-1) Avail: NTIS HC A03/MF A01

A methodological approach to the dynamic allocation of tasks in a man-machine symbiotic system in the context of dexterous manipulation and teleoperation is presented. This paper addresses symbiosis containing two symbiotic partners which work toward controlling a single manipulator arm for the execution of a series of sequential manipulation tasks. The proposed automated task allocator uses knowledge about the constraints/criteria of the problem, the available resources, the tasks to be performed, and the environment to dynamically allocate tasks to the man and the machine. The presentation of the methodology includes discussions concerning the characteristics of the man-machine symbiotic system, the interaction of the knowledge areas, the flow of execution, and the dynamic nature of the task allocation. DOE

N88-10493 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
GENDER AND COGNITIVE STYLE DIFFERENCES AT THE HUMAN-COMPUTER INTERFACE
C. J. H. Fowler and Dianne M. Murray Jun. 1987 16 p Presented at the 2nd IFIP International Conference on Human-Computer Interaction INTERACT 87, Stuttgart, West Germany, Sep. 1987
(NPL-DITC-90/87; ETN-87-90932) Copyright Avail: Issuing Activity

It is suggested that gender and cognitive style factors may be important in determining the most effective interface style for a particular user or user group, especially in the formative stages of human-computer interaction. Given the substantial evidence of differential treatment of the two sexes at school and at work, there is a need to increase the awareness of designers to the possibility of sex related individual differences at the level of the interface. There is also a great deal of work required in the schools, in order to ensure that both sexes receive equal treatment in computer exposure and usage. ESA

N88-10494 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
SYSTEM ADAPTIVITY AND THE MODELLING OF STEREOTYPES
David Benyon, Peter Innocent (Leicester Univ., England), and Dianne M. Murray Jun. 1987 14 p Presented at the 2nd IFIP International Conference on Human-Computer Interaction, INTERACT 87, Stuttgart, West Germany, Sep. 1987
(NPL-DITC-91/87; ETN-87-90933) Copyright Avail: Issuing Activity

Automatic adaptation of computer systems to the changing needs of users over time and to individual users or classes of users is discussed. The argument for adaptivity in a system is developed and related to theoretical work on adaptive interface design. Experiments to provide a formalism for system adaptivity are described. The experimental vehicle is a small CBT/tutoring system which incorporates embedded models of individual characteristics and student information in the form of stereotypic attributes and user profiles. Results suggest that the experimental paradigm must be refined, and a larger, more variable subject pool used. ESA

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N88-10495*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FRONTS PROPAGATING WITH CURVATURE DEPENDENT SPEED: ALGORITHMS BASED ON HAMILTON-JACOBI FORMULATIONS Final Report
Stanley Osher and James A. Sethian (California Univ., Berkeley.) Sep. 1987 54 p Submitted for publication
(Contract NAS1-18107; Grant NAG1-270)
(NASA-CR-178382; ICASE-87-66; NAS 1.26:178382) Avail: NTIS HC A04/MF A01 CSCL 12A

New numerical algorithms are devised (PSC algorithms) for following fronts propagating with curvature-dependent speed. The speed may be an arbitrary function of curvature, and the front can also be passively advected by an underlying flow. These algorithms approximate the equations of motion, which resemble Hamilton-Jacobi equations with parabolic right-hand-sides, by using techniques from the hyperbolic conservation laws. Non-oscillatory schemes of various orders of accuracy are used to solve the equations, providing methods that accurately capture the formation of sharp gradients and cusps in the moving fronts. The algorithms handle topological merging and breaking naturally, work in any number of space dimensions, and do not require that the moving surface be written as a function. The methods can be used also for more general Hamilton-Jacobi-type problems. The algorithms are demonstrated by computing the solution to a variety of surface motion problems. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N88-10496*# Ohio State Univ., Columbus. ElectroScience Lab.
IMPLEMENTATION OF A DIGITAL OPTICAL MATRIX-VECTOR MULTIPLIER USING A HOLOGRAPHIC LOOK-UP TABLE AND RESIDUE ARITHMETIC
Sarry F. Habiby Aug. 1987 163 p
(Grant NsG-3302)
(NASA-CR-180431; NAS 1.26:180431; TR-712257-6) Avail: NTIS HC A08/MF A01 CSCL 09B

The design and implementation of a digital (numerical) optical matrix-vector multiplier are presented. The objective is to demonstrate the operation of an optical processor designed to minimize computation time in performing a practical computing application. This is done by using the large array of processing elements in a Hughes liquid crystal light valve, and relying on the residue arithmetic representation, a holographic optical memory, and position coded optical look-up tables. In the design, all operations are performed in effectively one light valve response time regardless of matrix size. The features of the design allowing fast computation include the residue arithmetic representation, the mapping approach to computation, and the holographic memory. In addition, other features of the work include a practical light valve configuration for efficient polarization control, a model for recording multiple exposures in silver halides with equal reconstruction efficiency, and using light from an optical fiber for a reference beam source in constructing the hologram. The design can be extended to implement larger matrix arrays without increasing computation time. Author

N88-10497*# Lockheed-Georgia Co., Marietta.
HARDWARE FAULT INSERTION AND INSTRUMENTATION SYSTEM: MECHANIZATION AND VALIDATION Final Report
J. W. Benson Mar. 1987 33 p
(Contract NAS2-11853)
(NASA-CR-181445; NAS 1.26:181445; DOT/FAA/CT-86/31)
Avail: NTIS HC A03/MF A01 CSCL 09B

Automated test capability for extensive low-level hardware fault insertion testing is developed. The test capability is used to calibrate fault detection coverage and associated latency times as relevant to projecting overall system reliability. Described are modifications made to the NASA Ames Reconfigurable Flight Control System (RDFCS) Facility to fully automate the total test loop involving the Draper Laboratories' Fault Injector Unit. The automated capability provided included the application of sequences of simulated low-level hardware faults, the precise measurement of fault latency times, the identification of fault symptoms, and bulk storage of test case results. A PDP-11/60 served as a test coordinator, and a PDP-11/04 as an instrumentation device. The fault injector was controlled by applications test software in the PDP-11/60, rather than by manual commands from a terminal keyboard. The time base was especially developed for this application to use a variety of signal sources in the system simulator. Author

N88-10498# Stockholm Univ. (Sweden). Inst. of Physics.
A WORK STATION FOR EXELFS DATA ACQUISITION AND ANALYSIS
Chr. Bohm, B. Hovander, and H. Haakansson May 1987 12 p
(USIP-87-10; ETN-87-90753) Avail: NTIS HC A03/MF A01

An Extended Energy Loss Fine Structure (EXELFS) workstation based on an IBM or IBM compatible PC-AT is described. The standard hardware is augmented by a specially designed interface for data acquisition and for control of the EXELFS spectrometer. The interface is based on a programmable gate array in order to obtain a compact design while still allowing maximum flexibility. Software for interactive EXELFS analysis, which also serves as an aid when interpreting results, was developed. ESA

N88-10499# Technische Univ., Munich (West Germany). Fakultaet fuer Elektrotechnik.
DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERSION USING PULSE DURATION MODULATION Ph.D. Thesis [DIGITAL-ANALOG- UND ANALOG-DIGITAL-WANDLUNG MIT HILFE PULS-DAUER-MODULATION]
Wolf-Dieter Schleifer 1986 127 p In GERMAN
(ETN-87-90415) Avail: NTIS HC A07/MF A01

The possibilities of pulse duration modulation (PDM) in analog to digital (A/D) and digital to analog (D/A) conversion were investigated for a speech converter. The example of a large scale integration (LSI) circuit design is discussed. The comparison between practical measurements on LSI component and calculations using the simulation model demonstrates the efficiency of the method. The results show that A/D and D/A converters can be realized using the PDM method for the telephone speech frequency range. ESA

N88-10500# Royal Signals and Radar Establishment, Malvern (England).
THE VARIETIES OF CAPABILITIES IN FLEX
I. F. Currie and J. M. Foster Apr. 1987 30 p
(RSRE-MEMO-4042; BR102668; ETN-87-90982) Copyright
Avail: NTIS HC A03/MF A01

Flex capabilities implementation, control, and use are described. Capabilities in Flex are first class data objects used to define and limit the right to access data or obey an action. Their use extends from mainstores to filestores and across networks of Flexes. They are classified into mainstore, filestore, remote, and universal. Each of these varieties has its own range and lifetime designed to combine consistency, integrity, and utility with implementability. ESA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N88-10501# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
STUDY, DESIGN, AND EVALUATION OF DATA REDUCTION BY ENCODING OR INFORMATION EXTRACTION. PART 1: DATA GENERATION ANALYSIS Final Report
J. C. A. vanderLubbe, J. B. Boerger, and W. C. Huisman Paris, France ESA 1 Apr. 1985 74 p
(Contracts ESA-5724/83-NL-BI; NIVR-1075)
(NLR-TR-85094-L-Pt-1; ESA-CR(P)-2414-Vol-1; ETN-87-90550)
Avail: NTIS HC A04/MF A01

Past and future ESA payloads are surveyed and relevant classes of instruments are identified. For each of the classes of multispectral instruments, multiframe imaging instruments and

nonimaging instruments, those instruments whose data sets seem appropriate for the evaluation of the data compression methods are selected. The characteristics of the corresponding data sets are studied and theoretical image models are generated. ESA

N88-10502# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
STUDY, DESIGN AND EVALUATION OF DATA REDUCTION BY ENCODING OR INFORMATION EXTRACTION. PART 2: OPERATIONAL CONSIDERATIONS Final Report
J. B. Boerger Paris, France ESA 1 Apr. 1985 31 p
(Contracts ESA-5724/83-NL-BI; NIVR-1075)
(NLR-TR-85094-L-Pt-2; ESA-CR(P)-2414-Vol-2; ETN-87-90551)
Avail: NTIS HC A03/MF A01

Operational features related to the compression/decompression of data on board satellites are surveyed. Operational usage, error control, and instrument interfaces of a compressor in multispectral, multiframe, and nonimaging applications are discussed. Consequences for the system throughput speed, programmability, and power consumption are obtained. Multiframe applications are emphasized as they are of special interest to the space station. ESA

N88-10503# National Aerospace Lab., Amsterdam (Netherlands). Informatics and Space Div.
STUDY, DESIGN AND EVALUATION OF DATA REDUCTION BY ENCODING OR INFORMATION EXTRACTION. PART 3: ALGORITHM DESIGN Final Report
W. C. Huisman, J. C. A. vanderLubbe, J. Rooijackers (Technische Hogeschool, Delft, Netherlands), and W. Verhoef Paris, France ESA 13 Aug. 1985 141 p
(Contracts ESA-5724/83-NL-BI; NIVR-1075)
(NLR-TR-85094-L-Pt-3; ESA-CR(P)-2414-Vol-3; ETN-87-90552)
Avail: NTIS HC A07/MF A01

For the compression of multispectral imagery a spectral transform which exploits the main diagonal statistics of the interchannel covariance matrix was designed. Combined with the Chaturvedi algorithm overall performance deviates at most 0.25 bits/pixel from optimal Karhunen-Loeve spectral transform. For the compression of multiframe imagery conditional replenishment and straight-line approximation are described. Huffman coding, spline approximation, and meander method were reviewed for compression of scientific data generated by a non-imaging instrument. Meander performs best. Spline approximation appears to be unsuitable for EXOSAT data. Clustering was explored for compression of LANDSAT Thematic Mapper data. Reversible (error-free) compression is feasible by means of a hashing transform technique and a representation of all feature vectors by a feature occurrence tree structure. ESA

N88-10504# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
STUDY, DESIGN AND EVALUATION OF DATA REDUCTION BY ENCODING OR INFORMATION EXTRACTION. PART 4: PERFORMANCE DEMONSTRATION Final Report
W. Verhoef, J. B. Boerger, and W. C. Huisman Paris, France ESA 14 Jan. 1986 52 p
(Contracts ESA-5724/83-NL-BI; NIVR-1075)
(NLR-TR-85094-L-Pt-4; ESA-CR(P)-2414-Vol-4; ETN-87-90553)
Avail: NTIS HC A04/MF A01

Visual and numerical results of data compression techniques are presented. The results are for multispectral, multiframe, and nonimagery data as well as theoretically derived (artificial) data. ESA

N88-10505# National Aerospace Lab., Amsterdam (Netherlands). Informatics and Space Div.
STUDY, DESIGN AND EVALUATION OF DATA REDUCTION BY ENCODING OR INFORMATION EXTRACTION. PART 5: ALGORITHM IMPLEMENTATION ASPECTS Final Report
A. Monkel Paris, France ESA 5 Feb. 1986 28 p
(Contracts ESA-5724/83-NL-BI; NIVR-1075)
(NLR-TR-85094-L-Pt-5; ESA-CR(P)-2414-Vol-5; ETN-87-90554)
Avail: NTIS HC A03/MF A01

Implementation aspects of the data compression algorithms multispectral Chaturvedi and Meander into CADISS, HSPP, and VAX + AP120 processing systems are discussed. Functional partitioning and data partitioning approaches are reviewed, and data throughput is estimated. ESA

N88-10506# European Space Agency, Paris (France).
THE ASSOCIATIVE MEMORY ME7
Friedrich Lange Apr. 1987 60 p Transl. into ENGLISH of Der Assoziativspeicher ME7 (Oberpfaffenhofen, Fed. Republic of Germany, DFVLR) 1986 Original language document announced as N87-18344
(ESA-TT-1033; DFVLR-FB-86-31; ETN-87-90667) Avail: NTIS HC A04/MF A01; original report in German available from DFVLR, Cologne, West Germany DM 20

The associative memory ME7 is software which allows a particularly suitable table look-up representation of functions of several variables. A distributed memory provides the ability of generalization, so that after storing a function at several points of the address space also untrained regions can be recalled. All information is available at every instant and training can be irregular. As a result, the associative memory is also suited as a basis for learning systems. ESA

N88-10507# European Space Agency, Paris (France).
ESTIMATION OF THE POSITION AND ORIENTATION OF OBJECTS USING ASSOCIATIVE MEMORIES
Friedrich Lange Apr. 1987 48 p Transl. into ENGLISH of Schaetzung der Lage von Objekten mit Hilfe von Assoziativspeichern (Oberpfaffenhofen, Fed. Republic of Germany, DFVLR) 1986 Original language document announced as N87-18345
(ESA-TT-1034; DFVLR-FB-86-32; ETN-87-90668) Avail: NTIS HC A03/MF A01; original report in German available from DFVLR, Cologne, West Germany DM 17

An associative memory is used to estimate the position and orientation of an object from patterns of its TV-image. The patterns consist of average degrees of brightness in certain regions of the image. Several patterns with the according positions are fed into the associative memory. The memory can estimate the position of the object according to the patterns. The ability of generalization makes it possible to do so with untrained patterns. Changes in position are better recognized than modifications in orientation. ESA

N88-10508# British Aerospace Aircraft Group, Preston (England). Advanced Software Engineering Dept.
A BRIEF DISCUSSION OF FORMALLY BASED APPROACHES TO RAPID PROTOTYPING
R. D. Baxter 5 Mar. 1987 27 p
(BAe-WAA-RP-RES-SWE-440; ETN-87-90681) Copyright Avail: NTIS HC A03/MF A01

The use of software prototypes in the early stages of a system life-cycle to aid the transition from design to final implementation is discussed. It is shown how prototypes can evolve with experience and understanding. Formally based approaches which can lead to automated synthesis of software and the potential development of rapid prototyping environments are introduced. ESA

N88-10509# Royal Aircraft Establishment, Farnborough (England).
A USER'S GUIDE FOR BIE3D: A BOUNDARY INTEGRAL EQUATION COMPUTER PROGRAM FOR THREE-DIMENSIONAL ELASTOSTATIC ANALYSIS
K. W. Man Jul. 1986 44 p
(RAE-TM-MAT/STR-1078; BR100638; ETN-87-90696) Copyright Avail: NTIS HC A03/MF A01

A three-dimensional numerical stress analysis computer program based on the boundary integral equation (BIE) method was developed. Stress intensity factors can be derived for the case where the component is cracked. The body is assumed to

have linear elastic isotropic properties. Plane strain is assumed at all points along the crack front except where it intersects the free surface, where plane stress assumptions are made. The program is written in standard FORTRAN and is operational. Step-by-step instructions are presented with examples illustrating the input and output formats. Validation and accuracy checks of the computer program were made by solving two bench mark problems where the BIE solutions are compared with known accurate solutions. ESA

N88-10510 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
INPUT DEVICES FOR TASKS USING INTERACTIVE VIDEO
Cathy Thomas and Steve Milan Apr. 1987 35 p
(NPL-DITC-87/87; ISSN-0262-5369; ETN-87-90702) Copyright Avail: Issuing Activity

The optimum devices needed to enter information into a computer when using interactive video in a variety of contexts were studied. Novice and expert subjects performed typical tasks using the mouse, touchscreen, cursor keys, concept keyboard (a type of remote touch pad) and joystick. Measures of time, errors, and subjective preference were used for evaluation. Touch methods (touchscreen and concept keyboard) seem best for most of the tasks. There are differences of preference between novices and experts. Recommendations about which devices are best for certain types of person performing certain types of task in an interactive video environment are made. ESA

N88-10511# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A NEW PIVOTING RULE FOR THE DUAL NETWORK SIMPLEX METHOD
C. Roos 1987 33 p Sponsored by the Netherlands Organization for the Advancement of Pure Research
(Rept-87-17; B8711349; ISSN-0920-8577; ETN-87-90850)
Copyright Avail: NTIS HC A03/MF A01

A pivoting rule for the dual simplex method for solving the linear programming problem is applied to the network flow problem. This results in a pivoting rule for the dual network simplex method. The rule significantly reduces the number of required pivoting steps; the use of appropriate data structures significantly reduces computational times. Computational experiments are reported, including a comparison with the fastest dual and primal network codes existing, namely DUALINC and ARCNET respectively. The technique is better than DUALINC, and as good as ARCNET for small problems. ESA

N88-10512# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
AN EXPONENTIAL EXAMPLE FOR TERLAKY'S PIVOTING RULE FOR THE CRISS-CROSS SIMPLEX METHOD
C. Roos 1987 18 p
(Rept-87-18; B8711350; ISSN-0920-8577; ETN-87-90851)
Copyright Avail: NTIS HC A03/MF A01

The Terlaky (1985) pivoting rule for the criss-cross simplex method for linear programming is considered. Terlaky proved that the rule is convergent. It is shown that the required number of iterations may be exponential in the dimension of the problem. ESA

N88-10513# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
A NONMYTHICAL GENERALIZATION OF DEKKER'S ALGORITHM AND ITS RAMIFICATIONS
Jan Tijmen Udding and Wei Chen 1987 14 p
(CS-8702; ETN-87-90854) Avail: NTIS HC A03/MF A01

An algorithm to ensure mutual exclusion between processes is introduced. It is a straightforward generalization of Dekker's algorithm to an arbitrary number of processes. The algorithm is very simple and a process can be forced to wait at most once for every other process before being able to enter its critical section. Applying the same generalization technique to neighboring processes only, a solution to the Dining Philosophers Problem on a ring of processes of arbitrary number is easily derived. It is shown that the length of a contiguous string of blocked philosophers can be no more than four. ESA

N88-10514# Santa Fe Research Corp., N. Mex.
A CAMAC SYSTEM CONTROLLED BY AN IBM AT COMPUTER FOR TIME-RESOLVED SPECTROSCOPY
L. O. Lindquist and C. E. Moss 1987 4 p Presented at the 5th Conference on Real-Time Computer Applications in Nuclear, Particle and Plasma Physics, San Francisco, Calif., 11 May 1987 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(DE87-010111; LA-UR-87-1563; CONF-870552-13) Avail: NTIS HC A02/MF A01

An IBM AT computer interfaced to a small CAMAC system offers considerable power without the complexity and expense of a large general-purpose system. Our system for time-resolved spectroscopy features menu-driven FORTRAN-based software; high-resolution and high-speed (8K channels, 5-microsecond fixed dead time) ADCs; segmentable histogram memories (24-bit counts) with large memory space for many histogram segments; independently variable separate histogram dwell times; remote control via a CAMAC serial highway; and ground isolation between the data acquisition equipment and control computer by means of fiber optics. DOE

N88-10515# Stanford Univ., Calif. Systems Optimization Lab.
THE BOX METHOD FOR LINEAR PROGRAMMING. PART 1: BASIC THEORY
K. Zikan and R. W. Cottle Jun. 1987 21 p
(Contract DE-FG03-87ER-25028)
(DE87-011029; SOL-87-6-Pt-1) Avail: NTIS HC A03/MF A01

This paper presents a new interior-point algorithm for linear programming where the constraints are all expressed as inequalities. Along with the concept of minimum-weight basis, the algorithm features a novel mechanism for finding search directions. Unlike other interior-point methods which implicitly or explicitly involve optimization over ellipsoids for their direction-finding schemes, the one reported here uses boxes. The corresponding subproblems are simple linear programs having closed form solutions. It is shown that the iterates generated by the algorithm converge to an extreme point of the feasible region. When this point is nondegenerate, it is optimal and reached within finitely any step. The methodology introduced here also gives rise to a polyhedral subdivision of the problem's feasible region and in fact to the entire space of decision variables. DOE

N88-10516# Illinois Benedictine Coll., Lisle. Dept. of Mathematics and Computer Science.
A GRAPHICAL TOOL FOR OBSERVING THE BEHAVIOR OF PARALLEL LOGIC PROGRAMS
T. Disz and E. Lusk Mar. 1987 15 p Presented at the 4th Symposium on Logic Programming, San Francisco, Calif., 31 Aug. 1987 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE87-011467; CONF-870899-1) Avail: NTIS HC A03/MF A01

A graphical tool is described that has been useful in studying and improving the behavior of parallel logic programs. The parallel logic programming system being studied is ANLWAM, a parallel version of the Warren abstract machine that runs on a variety of shared-memory multiprocessors. The graphical tool, called WAMTRACE, currently runs on Sun workstations. The coupling between the two is not close, and WAMTRACE can easily be interfaced to other parallel systems. We describe here the features of the system, and give several examples of how it can be used to improve one's understanding of both a parallel logic program and the system that provides its parallel execution environment. DOE

N88-10517# Argonne National Lab., Ill.
A LOOK AT THE EVOLUTION OF MATHEMATICAL SOFTWARE FOR DENSE MATRIX PROBLEMS OVER THE PAST FIFTEEN YEARS
J. J. Dongarra and D. C. Sorensen 1987 15 p Presented at the International Seminar on Scientific Supercomputers, Paris, France, 2 Feb. 1987 Prepared in cooperation with Illinois Univ., Urbana
(Contracts DE-FG02-85ER-25001; W-31-109-eng-38; DE-AC05-84OR-21400)
(DE87-011485; CONF-870294-1) Avail: NTIS HC A03/MF A01

This paper looks at the evolution which has taken place in the design of mathematical software for dense matrix problems. Also examined are the problems facing implementation of such algorithms on a large number of processors. The main emphasis is on algorithms for solving linear algebra problems where the software developed would reside in a library on high-performance computers. DOE

N88-10518# Oak Ridge National Lab., Tenn.
AN EVALUATION OF WPS-PLUS WORD PROCESSING SOFTWARE FOR THE IBM PC AND COMPATIBLES
C. A. Reeves, Jr. and D. M. Turpin Jun. 1987 14 p
(Contract DE-AC05-84OR-21400)
(DE87-011972; ORNL/CSD/TM-254) Avail: NTIS HC A03/MF A01

An evaluation was performed on WPS-Plus/Workstation PC-based word processing software available from the Digital Equipment Corporation (DEC). This review concentrated on two areas: review of the built-in DEC VT100/220/240 terminal emulation software, and evaluation of the word processing functions themselves, with the former being the primary point of emphasis. The software was found in general to compare favorably with similar software residing in the DEC VAX computers, and files generated with WPS-Plus/Workstation can be transferred to the VAX computers and edited with WPS-Plus in the VAX and vice-versa, with all formatting codes intact. However, many functions most users have grown to expect in word processing software are lacking in the WPS-Plus/Workstation. Thus the product can only be recommended for those who use WPS-Plus on the VAX and desire the same user interface and functionality in a personel computer product. DOE

N88-10519*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS AND SYNTHESIS OF ABSTRACT DATA TYPES THROUGH GENERALIZATION FROM EXAMPLES Final Report
Christian Wild Sep. 1987 25 p Submitted for publication Prepared in cooperation with Old Dominion Univ., Norfolk, Va.
(Contract NAS1-18107)
(NASA-CR-178369; ICASE-87-59; NAS 1.26:178369) Avail: NTIS HC A03/MF A01 CSCL 09B

The discovery of general patterns of behavior from a set of input/output examples can be a useful technique in the automated analysis and synthesis of software systems. These generalized descriptions of the behavior form a set of assertions which can be used for validation, program synthesis, program testing, and run-time monitoring. Describing the behavior is characterized as a learning process in which the set of inputs is mapped into an appropriate transform space such that general patterns can be easily characterized. The learning algorithm must chose a transform function and define a subset of the transform space which is related to equivalence classes of behavior in the original domain. An algorithm for analyzing the behavior of abstract data types is presented and several examples are given. The use of the analysis for purposes of program synthesis is also discussed. Author

N88-10520*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
MANUAL FOR GETDATA VERSION 3.1: A FORTRAN UTILITY PROGRAM FOR TIME HISTORY DATA
Richard E. Maine Oct. 1987 146 p
(NASA-TM-88288; H-1403; NAS 1.15:88288) Avail: NTIS HC A07/MF A01 CSCL 09B

This report documents version 3.1 of the GetData computer program. GetData is a utility program for manipulating files of time history data, i.e., data giving the values of parameters as functions of time. The most fundamental capability of GetData is extracting selected signals and time segments from an input file and writing the selected data to an output file. Other capabilities include converting file formats, merging data from several input files, time skewing, interpolating to common output times, and generating calculated output signals as functions of the input signals. This report also documents the interface standards for the subroutines used by GetData to read and write the time history files. All interface to the data files is through these subroutines, keeping the main body of GetData independent of the precise details of the file formats. Different file formats can be supported by changes restricted to these subroutines. Other computer programs conforming to the interface standards can call the same subroutines to read and write files in compatible formats. Author

N88-10521# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REPORT OUTLINE OF A PROGRAMMING VARIABLE AND APPLICATION THROUGH EXAMPLE [NOCAO DE HISTORICO DE UMA VARIAVEL E APLICACAO A PROGRAMACAO PELO EXEMPLO]
Gerald Jean Francis Banon Jul. 1987 13 p In PORTUGESE Presented at the 3rd Regional Meeting of Applied Mathematics and Computation, Sao Jose dos Campos, Brazil, 18-20 May 1987
(INPE-4211-PRE/1092) Avail: NTIS HC A03/MF A01

This work introduces an explanation of a variable and shows how much this concept can serve as a base for a new programming technique, roll call programming through example, as dispensation to the program edition phase in its traditional form is guaranteed in the synthesis of the program with attractive security operations. That technique is illustrated through an example of function creation in the APL environment. Author

N88-10522# Lawrence Livermore National Lab., Calif.
TIPS-1 USER'S MANUAL: CRAY-1 VERSION
G. W. Laguna 15 Jul. 1987 111 p
(Contract W-7405-eng-48)
(DE87-013297; UCID-20545) Avail: NTIS HC A06/MF A01

This report provides a user's manual for the Lawrence Livermore National Laboratory (LLNL) version of the solid modeler TIPS-1. TIPS-1/LLNL allows users to define complete geometric and topological descriptions of objects which can then be acted upon by applications such as mass properties, graphics, and radiograph simulations. TIPS-1/LLNL is available only on the Crays. DOE

N88-10523# Lawrence Livermore National Lab., Calif.
ADAPTIVE LINE OF SIGHT ALGORITHMS
R. M. Tom 25 Aug. 1987 13 p
(Contract W-7405-eng-48)
(DE87-014275; UCRL-53812) Avail: NTIS HC A03/MF A01

The determination of obstructions of line of sight (LOS) between two arbitrary combat positions is a compute-intensive process for those simulators that model three-dimensional terrain. Computer implementation of LOS can dominate simulation run time for some scenarios. Relatively inexpensive computer systems are now becoming available that feature large random access memories. An adaptive procedure for LOS determination is contained in this concept paper that exploits the memory-rich environment to achieve increased speed of operation. Heuristic information about the way terrain LOS behaves in the real world plays a vital role in the procedure. A key feature of the approach is that it permits the order of LOS filters to be dynamically adjusted to test the most probable cause of obstruction first. The proposed algorithm permits a designer to effectively trade memory for run time and is aimed at a spectrum of machine sizes. The approach has the potential to be considerably more efficient than the algorithms now in use. DOE

N88-10524# Los Alamos National Lab., N. Mex.
BOUNDARY INTEGRAL TECHNIQUE FOR PERFORMING ANALYSIS OF TWO-DIMENSIONAL VOLUMES OF REVOLUTION
R. M. Dolin Aug. 1987 80 p
(Contract W-7405-eng-36)
(DE87-013053; LA-11020-MS) Avail: NTIS HC A05/MF A01

This report describes how beam and mass property analysis is performed within the initial graphics exchange specification (IGES)-compatible code called IGVIEW. This software is used at the Los Alamos National Laboratory to display and edit two-dimensional IGES-formatted geometry. IGVIEW was written to comply with IGES version 4.0, which is the current national geometry standard. This report discusses how IGVIEW uniquely defines parts and how geometry is analyzed using a boundary integral technique. The development of the boundary integral equations is provided. DOE

N88-10525# Sandia National Labs., Albuquerque, N. Mex.
DETOUR: A DEFORMED MESH/CONTOUR PLOT PROGRAM
A. P. Gilkey and D. P. Flanagan Jul. 1987 57 p
(Contract DE-AC04-76DP-00789)
(DE87-013119; SAND-86-0914) Avail: NTIS HC A04/MF A01

DETOUR is a graphics program for the post-processing of two-dimensional finite element analyses. It produces mesh plots with various representations of the analysis output variables. The major capabilities of DETOUR are deformed mesh plots, line contours, filled (painted) contours, vector plots of two variables (e.g., velocity vectors), and symbol plots of scalar variables (e.g., discrete cracks). DETOUR's features include free-format command input, element selection by material, element birth and death, multiple views for combining several displays on each plot, and symmetry mirroring. DETOUR can drive any graphics device supported by the Sandia Virtual Device Interface and operates in either interactive or batch modes. DOE

N88-10526# California Univ., Berkeley. Lawrence Berkeley Lab.
EVA REFERENCE MANUAL
R. A. Belshe Jun. 1987 26 p
(Contract DE-AC03-76SF-00098)
(DE87-014073; LBL-PUB-3062) Avail: NTIS HC A03/MF A01

EVA is a program used for creating one-dimensional (1-D) and two-dimensional (2-D) spectra from event tapes. In order to create these spectra an algorithm is written in the EVAL language which describes both the structure of a single event and the analysis to be done on each event. The process of sorting an event tape is then simply to repeat this algorithm for each of the millions of events on the tape. The EVA language has been defined to easily describe such algorithms, and a compiler has been written to produce optimum machine code for each individual set of sorting conditions. This allows the user full control over the handling of the events and produces code which runs much faster than a generalized FORTRAN program. This manual describes the implementation of sorting programs using the EVA compiler for the Modcomp CLASSIC computers at LBL. When used with the program GATES, it allows free-form 2-dimensional regions to be used as gates. DOE

N88-10527*# Old Dominion Univ., Norfolk, Va. Dept. of Electrical and Computer Engineering.
STRATEGIES FOR CONCURRENT PROCESSING OF COMPLEX ALGORITHMS IN DATA DRIVEN ARCHITECTURES Interim Report, 1 Jun. 1986 - 15 May 1987
John W. Stoughton and Roland R. Mielke Nov. 1987 71 p
(Contract NAG1-683)
(NASA-CR-181435; NAS 1.26:181435) Avail: NTIS HC A04/MF A01 CSCL 09B

The results of ongoing research directed at developing a graph theoretical model for describing data and control flow associated with the execution of large grained algorithms in a spatial distributed computer environment is presented. This model is identified by the acronym ATAMM (Algorithm/Architecture Mapping Model). The purpose of such a model is to provide a basis for establishing rules for relating an algorithm to its execution in a multiprocessor environment. Specifications derived from the model lead directly to the description of a data flow architecture which is a consequence of the inherent behavior of the data and control flow described by the model. The purpose of the ATAMM based architecture is to optimize computational concurrency in the multiprocessor environment and to provide an analytical basis for performance evaluation. The ATAMM model and architecture specifications are demonstrated on a prototype system for concept validation. Author

N88-10528# Lanchester Polytechnic, Coventry (England). Dept. of Mathematics.
PERFINE: PERSONAL FINITE ELEMENTS ON A MICROCOMPUTER
K. E. Barrett, D. M. Butterfield, S. Ellis, and J. H. Tabor Feb. 1987 25 p
(ETN-87-90678) Avail: NTIS HC A03/MF A01

A finite element package to analyze quite complex problems involving linear elasticity and potential flow was developed. The user interface was designed so that little knowledge of the finite element method is needed beyond the basic ideas. Where possible information is input and checked graphically and results are handled in a similar fashion. Modules for mesh generation, problem setting, problem analysis, and post processing of results are provided. The package is limited to problems in two dimensional and axisymmetric geometries. ESA

N88-10529# Politecnico di Milano (Italy). Dipt. di Elettronica.
PETRI NETS AS A SUPPORT TO SYMBOLIC EXECUTION OF CONCURRENT Ada PROGRAMS
Carlo Ghezzi, Dino Mandrioli, and Mauro Pezze 1987 21 p
(Rept-87-007; ETN-87-90766) Avail: NTIS HC A03/MF A01

In order to provide a basis for a general testing and verification environment, a model of concurrency based on the Petri nets formalism, and a translation algorithm from a subset of the Ada task system to the proposed formalism are given. Symbolic execution of concurrent programs is discussed, with reference to the considered Ada subset, on the basis of the proposed formalism. Problems due to scheduling and synchronization are considered, and solutions are proposed. The algorithm provides enough information for test data selection, allows the reproducible execution of a concurrent program, and can detect unfeasible rendezvous sequences. ESA

N88-10530# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
DEVELOPMENT OF A LINE-DRAWING ALGORITHM
Johan B. Swenker 30 Jan. 1987 14 p
(CS-8701; ETN-87-90853) Avail: NTIS HC A03/MF A01

An algorithm for coloring squares is presented. It solves the following problem. Consider a squared paper and a line segment whose end points are centers of squares. The problem is to color all squares that intersect the line segment. The algorithm can be used to draw an approximation of the line segment on a raster display. ESA

N88-10531# Technische Univ., Munich (West Germany). Fakultaet fuer Elektrotechnik.
AN INTERACTIVE OPTIMIZATION PROCEDURE FOR THE COMPUTER AIDED DIMENSIONING OF INTEGRATED CIRCUITS Ph.D. Thesis [EIN INTERAKTIVES OPTIMIERUNGSVERFAHREN ZUR RECHNERGESTUETZTEN DIMENSIONIERUNG INTEGRIERTER SCHALTUNGEN]
Peter Leibner 1986 104 p In GERMAN
(ETN-87-90414) Avail: NTIS HC A06/MF A01

A computer assisted deterministic, iterative procedure for the dimensioning of electric transistor circuits, based on circuit analysis methods, was developed. The iteration procedure uses circuit simulation and a gradient evaluation. Suitable dominant optimization parameters and switching characteristics were chosen to obtain a reduction of the dimension of the design system, and hence a

reduced effort in the calculation of the switching sensitivities. The choice of the parameters and characteristics was described by the Gram-Schmidt orthogonalization method. The applicability of the procedure is demonstrated by examples from industrial practice. The procedure was implemented in the program OPDIC. ESA

N88-10532# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Mathematische Verfahren und Datentechnik.
MAXIMUM LIKELIHOOD ESTIMATES OF PARAMETERS IN LINEAR SYSTEMS WITH PROCESS AND MEASUREMENT NOISE
Ravindra Jategaonkar and Ermin Plaetschke Jun. 1987 51 p Sponsored by Technische Univ., Brunswick, West Germany
(DFVLR-FB-87-20; ISSN-0171-1342; ETN-87-91009) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 19.50

A FORTRAN program to estimate flight mechanical parameters in linear systems was developed. The maximum likelihood method which accounts for process and measurement noise is used. The algorithm is based on Kalman filter for the linear state estimation problem, explicit estimation of covariance of residuals, and modified Newton-Raphson method for parameter update. Several computational options were incorporated to enable convenient application in different practical situations. Utility of the algorithm is demonstrated. ESA

N88-10533# RE/SPEC, Inc., Albuquerque, N. Mex.
NOSTRADAMUS PROGRAMMABLE TRANSLATOR USER'S MANUAL AND PROGRAMMER'S MANUAL
J. D. Harmon Jul. 1987 79 p Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE87-013414; SAND-87-0700) Avail: NTIS HC A05/MF A01

One of the disadvantages in using supercomputers to run engineering analysis codes is that the binary files produced on the supercomputer may be incompatible with postprocessing programs running on a different machine. It is therefore necessary to translate these binary files into a form that is readable by the machines used for postprocessing. Described herein is a programmable translator that translates data produced by one of these analysis codes from the binary format of the Cray supercomputer to the functional equivalent for the Digital Equipment Corporation VAX machines. The general usage of this translator is discussed, as well as the programming language for the translator and some of the finer points of the use of this language. Several programming examples are also included. DOE

N88-10534# Los Alamos National Lab., N. Mex.
A REFERENCE GUIDE FOR IGVIEW: AN IGES-COMPATIBLE GEOMETRY SYSTEM
Ronald M. Dolin and Dwight L. Jaeger Aug. 1987 128 p
(Contract W-7405-eng-36)
(DE87-013441; LA-11025-M) Avail: NTIS HC A07/MF A01

This report provides an introduction to the Initial Graphics Exchange Specification (IGES)-compatible code called IGVIEW. This software is used to display, edit, and analyze two-dimensional IGES formatted geometry. IGVIEW was written to comply with IGES Version 4.0, which is the current national geometry standard. This report is intended to serve as a reference manual for IGVIEW users. It contains a description of all possible commands and how to execute them. It details how to execute the code, read in a geometry file, and write a geometry file. There is also a discussion about what types of computer systems and terminals the current version of IGVIEW will support. The procedures for developing a material library are shown, and a short example library is provided. DOE

N88-10535# Lawrence Livermore National Lab., Calif.
UNIFIED SUN AND SKY ILLUMINATION FOR SHADOWS UNDER TREES
N. Max 12 Jan. 1987 24 p Presented at the ACM SIGGRAPH Conference, Anaheim, Calif., 27 Jul. 1987
(Contract W-7405-eng-48)
(DE87-014232; UCRL-95911; CONF-870738-3) Avail: NTIS HC A03/MF A01

Assume the Sun, sky and clouds are represented as a raster image on a plane at infinity, and the shadows of a tree canopy are represented as a raster transparency mask on a canopy plane. Then the illumination on the ground is the correlation of these two rasters, which can be rapidly computed by Fast Fourier Transform techniques. DOE

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N88-10536# New York Univ., New York. Courant Inst. of Mathematical Sciences.
A PARALLEL MODEL OF THE KINETIC DEPTH EFFECT USING LOCAL COMPUTATIONS
Michael S. Landy Jun. 1986 48 p
(Contract N00014-85-K-0077)
(AD-A181945; TR-86-2) Avail: NTIS HC A03/MF A01 CSCL 09B

This paper defines a new model for the Kinetic Depth Effect for multi-dot stimuli. The calculation is performed in a cooperative-competitive network, described as a relaxation labeling process (RLP). The process involves a local iterative computation to best meet the constraints indicated by image cues to depth. Given a constraint that prefers inter-Dot distances in 3D to remain constant (local rigidity), the model becomes a local parallel computation of the Ullman incremental rigidity scheme. Several simulations of the model are described, including some where additional cues are combined with the changing dot position cue. GRA

N88-10537# Saab-Space A.B., Linkoeping (Sweden).
DIGITAL BUS UNIT ENGINEERING MODEL: DESIGN, MANUFACTURE AND TEST Final Report
Bertil Linder, Bo Svensson, Tore Lundberg, and Sigvard Delborg Paris, France ESA Aug. 1986 70 p
(Contracts ESTEC-5780/83-NL-BI; ESTEC-5283/82-NL-HP)
(MRM/TREP/1003/SAAB; ESA-CR(P)-2409; ETN-87-90546)
Avail: NTIS HC A04/MF A01

An onboard data handling (OBDH) digital bus unit (DBU) was developed. The DBU contains: protection, input filter, and transformer coupling to the OBDH data bus; bus adapter, performing modulation and demodulation in order to be able to transmit and receive on the data bus; and a standard interface to the user equipment, functionally connected to the data bus, the digital bus interface. The main mission of the DBU is a modem function. ESA

N88-10538# Saab-Space A.B., Linkoeping (Sweden). Data Communication Section.
STUDY AND DESIGN OF A COMMUNICATION PROCESSOR UNIT Final Report
Sven Dahlstroem, Bjoern Hansson, and Torbjoern Hult Paris, France ESA Oct. 1986 74 p
(Contract ESTEC-5780/83-NL-BI)
(RIDU/TREP/1002/SAAB; ESA-CR(P)-2410; ETN-87-90547)
Avail: NTIS HC A04/MF A01

The functional requirements and a specification of external interfaces and protocols of a communication processor unit for onboard data handling were defined. The operation of the communication processor and analysis of the test philosophy are described. Hardware for the communication processor was designed. The unit specification was updated and a detailed design report was produced together with electrical circuit diagrams. Software for the communication processor was produced and a software specification was written. Software flow charts were established. ESA

N88-10539# National Bureau of Standards, Gaithersburg, Md.
MEASUREMENT OF FAULT-TOLERANT PARALLEL PROCESSORS
J. W. Roberts, A. Mink, and R. J. Carpenter May 1987 50 p
Sponsored by DARPA, Arlington, Va.
(PB87-208328; NBSIR-87/3568) Avail: NTIS HC A03/MF A01 CSCL 09B

Computer systems that continue to operate correctly in the presence of faults are vital for many important applications. A number of measurement techniques can be used to determine how well computers detect and recover from faults. Both time to recover and degree of recovery can be measured. GRA

N88-10540# Texas Univ., Austin. Dept. of Computer Sciences.
A UNIFIED APPROACH TO PARALLEL COMPUTATION: PERFORMANCE EVALUATION AND ARCHITECTURALLY INDEPENDENT PARALLEL PROGRAMMING Progress Report, 1 Sep. 1986 - 31 Aug. 1987
J. C. Browne 15 May 1987 8 p
(Contract DE-FG05-85ER-25010)
(DE87-012519; DOE/ER-25010/2) Avail: NTIS HC A02/MF A01

This report is a summary of research in the area of parallel programming. Research accomplishments include formalization of a model of parallel computation, application of the model to architecturally independent graphics problems, and resource management of parallel architectures. DOE

N88-10541# Lawrence Livermore National Lab., Calif.
EAGLES: AN INTERACTIVE ENVIRONMENT FOR SCIENTIFIC COMPUTING
B. S. Lawver, D. W. OBrien, M. E. Poggio, and R. M. Shectman 11 May 1987 5 p Presented at the 5th Conference on Real-Time Computer Applications in Nuclear, Particle and Plasma Physics, San Francisco, Calif., 11 May 1987
(Contract W-7405-eng-48)
(DE87-013564; UCRL-96192; CONF-870552-24) Avail: NTIS HC A02

The EAGLES Project is creating a computing system and interactive environment for scientific applications using object-oriented software principles. This software concept leads to well defined data interfaces for integrating experiments control with acquisition and analysis codes. Tools for building object-oriented systems for user interfaces and codes are discussed. Also the terms of object-oriented programming are introduced and later defined in the appendix. These terms include objects, methods, messages, encapsulation and inheritance. DOE

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N88-10542# American Association for Artificial Intelligence, Menlo Park, Calif.
WORKSHOP ON AI (ARTIFICIAL INTELLIGENCE) AND SIMULATION (2ND) HELD IN SEATTLE, WASHINGTON ON 14 JULY 1987
Paul A. Fishwick, Richard B. Modjeski, Bernard P. Ziegler, Ramana Reddy, Marilyn Stelzner, and Malcolm R. Railey (BDM Corp., McLean, Va.) Jul. 1987 140 p Workshop held in Seattle, Wash., 14 Jul. 1987; sponsored by AAAI
(AD-A183736) Avail: NTIS HC A07/MF A01 CSCL 09B

The Second Artificial Intelligence (AI) and Simulation Workshop was held during the National Conference on Artificial Intelligence on July 14, 1987 at the University of Washington, Seattle. The abstracts and papers pertain to such topics as: Artificial Intelligence; Computer Science; Computer Simulation Modeling; Expert Systems; Knowledge Based Simulation; Computer Modeling; Operations Research; Qualitative Simulation; and Simulation. GRA

N88-10543# Duisburg Univ. (West Germany). Fachgebiet Mess-, Steuer- und Regelungstechnik.
ADAPTIVE CONTROL OF HYDRAULIC DEVICES [ADAPTIVE REGELUNG HYDRAULISCHER ANTRIEBE]
Albert Koeckemann 1985 67 p In GERMAN
(FB-1/85; ETN-87-90382) Avail: NTIS HC A04/MF A01

An adaptive control concept for translational hydraulic drives, which can be realized in real time using a microcomputer is described. The hydraulic drive consists of an hydraulic cylinder and a servovalve. Two methods for the synthesis of hydraulic drive control systems are presented. The applicability of the concept was tested using digital simulation. It is shown that the very good control behavior can be obtained. The controller adjusts itself automatically during the start-up phase, and adapts to the nonlinearities of the system. However, the controller in its proposed form can practically not be used for real drives. Therefore, a modified adaptive control concept robust enough for technical applications was proposed and was demonstrated to be suitable. ESA

N88-10544# Royal Signals and Radar Establishment, Malvern (England).
LANGUAGE MODELLING FOR AUTOMATIC SPEECH RECOGNITION: A REVIEW
L. Dodd and S. R. Johnson Apr. 1987 22 p
(RSRE-Memo-4038; BR102355; ETN-87-90695) Copyright Avail: NTIS HC A03/MF A01

Language models and the ways of formalizing linguistic knowledge are introduced. Techniques for applying phonological, syntactic, and semantic constraints to automatic speech recognition are discussed. ESA

N88-10545# Politecnico di Milano (Italy). Dipt. di Elettronica.
MULTIMEDIA SENSORY SYSTEMS FOR THE SOLUTION OF THE ERROR RECOVERY PROBLEM
V. Caglioti, R. Simino, and M. Somalvico 1987 55 p
(Rept-87-010; ETN-87-90767) Avail: NTIS HC A04/MF A01

A three-phase error recovery strategy for intelligent assembly robots is outlined: deduction of the task, starting from the assigned program and from possible further information; detection of the error situation, through the use of sensors; and planning a correcting strategy, whose execution allows the correct accomplishment of the robot task, in spite of the error. An off-line module makes a knowledge based task deduction to represent the desired world state. An on-line module, after an error plans a dynamic sequence of sensory detections, to acquire knowledge to construct a useful description of the actual (error) situation. A third (on-line) module plans a correcting strategy, using as starting state the description of the error state (provided by the second module), and using as target state one of the desired evolving states (provided by the task deduction module). ESA

N88-10546# Erlangen-Nuremberg Univ. (West Germany). Fakultaet der Technik.
DIGITAL ALGORITHMS FOR THE CONTROL AND DYNAMIC DECOUPLING OF INDUSTRIAL ROBOT AXES Ph.D. Thesis [DIGITALE ALGORITHMEN ZUR REGELUNG UND DYNAMISCHEN ENTKOPPLUNG VON INDUSTRIEROBOTERACHSEN]
Herbert Ebach 1985 141 p In GERMAN
(ETN-87-90441) Avail: NTIS HC A07/MF A01

Identification methods and digital control algorithms for a robot axis control system were compared. The principle of nonlinear systems decoupling is explained. The models, required for the discrete control design, were checked and improved by measurements. The state control concept with perturbed quantities observers is the most complicated solution to fulfil the requirements. The deadbeat controller is simple to realize in digital technique, but its use is difficult. State cascade control is simpler to design than state control, but it has a smaller dynamic range.

Measurements show that the usual 16-bit processors with additional hardware are suitable for the floating point arithmetic for the axis control with respect to calculation speed and accuracy. Measurements confirm the control designs. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N88-10547# Army Research Office, Research Triangle Park, N.C.
TRANSACTIONS OF THE 4TH ARMY CONFERENCE ON APPLIED MATHEMATICS AND COMPUTING
Feb. 1987 1374 p Conference held in Ithaca, N.Y., 27-31 May 1986
(AD-A183544; ARO-87-1) Avail: NTIS HC A99/MF A05 CSCL 12A

The Fourth Army Conference on Applied Mathematics and Computing was held 27-30 May 1986 at Cornell University, Ithaca, New York. It coincided with the formal opening of the recently established Mathematical Sciences Institute (MSI). This meeting's seven invited speakers addressed the vital areas of combustion, computational fluid dynamics, parallel computation, stochastic analysis, multiple bifurcation, numerical solutions of partial differential equations and problems in many scales of length and time in modern computing environments. There were two special sessions that dealt with Stochastic Algorithms and Computational Vison, and Probabilistic Methods in Solid Mechanics. There were one hundred and eight contributed technical papers. This meeting provided its attendees a chance to see many scientific developments taking place in the various Army laboratories. Through these meetings, techniques developed at one installation are brought to the attention of scientists at other places, this reducing duplication of effort. Another important phase of these meetings is presenting the members of the audience an opportunity to hear nationally known scientists discuss recent developments of their own fields. GRA

N88-10548 Deutsche Geodaetische Kommission, Munich (West Germany).
ANALYTICAL TREATMENT OF THE SPATIAL TRILATERATION PROBLEM (4, 6, 0, 0) [ANALYTISCHE BEHANDLUNG DES RAEUMLICHEN TRILATERATIONSPROBLEMS (4, 6, 0, 0)]
Oswald Giering 1986 54 p In GERMAN Presented at the 11th Oesterreichischen Mathematikerkongress, Graz, Austria, 16-20 Sep. 1985
(Ser-A-104; ISBN-3-7696-8186-X; ISSN-0065-5309; ETN-87-90354) Copyright Avail: Issuing Activity

A method for the analytical solution of spatial trilateral problems was developed. The system of 24 quadratic equations, I, for noncoplanar standpoints was successively transformed. The procedure is tailored to the determination of a discrete solution when an approximation solution is given. The method requires a great effort for the determination of all discrete solutions of the trilateration problem, but is in principle usable. The system I was also treated for coplanar (noncollinear) standpoints; discrete solutions are not possible in this case, but always groups of solutions with two to four parameters. ESA

N88-10549# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany). Abteilung Waerme.
THE RELIABILITY OF NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS, OBTAINED BY IMPLICIT CALCULATION SCHEMES [BERICHT UEBER DIE ZUVERLAESSIGKEIT NUMERISCHER LOESUNGEN GEWOEHNLICHER DIFFERENTIALGLEICHUNGEN, GEWONNEN UNTER BENUTZUNG IMPLIZITER RECHNUNGS-SCHEMATA]
Stefan Golos Jul. 1986 38 p In GERMAN
(PTB-W-30; ISBN-3-88-314-573-4; ISSN-0341-6739; ETN-87-90392) Avail: NTIS HC A03/MF A01

The reliability of the application of implicit calculation schemes for solving numerically large systems of ordinary differential equations, such as in the case of unsteady heat transfer, is discussed. It is shown that the implicit schemes are not unconditionally stable. Where the calculation process becomes unstable, the reliability of the results is questionable. A condition under which an implicit scheme is automatically transformed into an explicit one, thereby eliminating the risk of numerical instability, is proposed. Control calculations confirm that this condition leads to improved numerical results. ESA

N88-10550 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
THE USE OF SPLINES IN THE MODELLING OF A PHOTODIODE RESPONSE
P. M. Harris Apr. 1987 26 p
(NPL-DITC-88/87; ISSN-0262-5369; ETN-87-90703) Copyright Avail: Issuing Activity

It is shown how spline surfaces may be used to provide an approximation to an underlying function represented only by noisy data, when two independent variables are present. When the data is specified on a rectangular mesh, separability can be exploited to reduce the work involved through solving two related, but simpler, fitting problems. The fitting leads to a convenient representation of the data which allows manipulation of the underlying function mathematically. Differentiation and computation of convolutions is outlined. The fitting, differentiation, and convolution were applied to model a photodiode response. ESA

N88-10551# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
CLUSTERING BY MEANS OF MEDOIDS
Leonard Kaufman (Vrije Universiteit, Brussels, Belgium) and Peter Rousseeuw 1987 21 p
(Rept-87-03; B8703521; ISSN-0920-2358; ETN-87-90836) Copyright Avail: NTIS HC A03/MF A01

An approach to partitioning a set of objects into k clusters is outlined. It searches for k representative objects, called medoids, which minimize the average dissimilarity of all objects of the data set to the nearest medoid. A cluster is then defined as the set of objects assigned to the same medoid. An algorithm for this method was implemented in a program which is described. The k-medoid method does not require the actual measurement data as it can also be applied to a collection of dissimilarities. Such dissimilarities are for example subjective assessments of relationships between objects, in which case no measurements exist. An example of the latter type is analyzed. The k-medoid method is less susceptible to outlying values than sums of squares methods. ESA

N88-10552# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
SOLUTION METHODS FOR BIDIAGONAL AND TRIDIAGONAL LINEAR SYSTEMS FOR PARALLEL AND VECTOR COMPUTERS
Peter H. Michielse 1987 27 p Sponsored by Koninklijke/Shell-Lab. B.V.
(Rept-87-04; B8705953; ISSN-0920-2358; ETN-87-90837) Copyright Avail: NTIS HC A03/MF A01

The recursive doubling method for bidiagonal linear systems by which the complete solution process for $Ax = b$, where A is a bidiagonal matrix, can be carried out in several parallel parts, is examined. Wang's (1981) partition method is applied to these bidiagonal systems, and a completely parallel method for tridiagonal systems is studied. The latter methods are shown to offer an advantage over the recursive doubling method. Vector aspects of the algorithms mentioned are discussed. ESA

N88-10553# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
DATA MODEL OF OBJECTS AND RELATIONS (DAMOR): A DATA MODEL FOR KNOWLEDGE REPRESENTATION
Willem Jonker 1987 24 p Sponsored by the MEDES project
(Rept-87-05; B8705772; ISSN-0920-2358; ETN-87-90838) Copyright Avail: NTIS HC A03/MF A01

(Rept-87-05; B8705772; ISSN-0920-2358; ETN-87-90838)
Copyright Avail: NTIS HC A03/MF A01

A data model for knowledge representation based on frame-like objects is described. It consists of two levels of description: a definition level and an individual level. The first level describes the kind of objects in the problem area, the second level the actual objects. Definition objects can be placed in a hierarchy by means of connections; this hierarchy serves as the backbone of the inheritance. An extension to traditional frame systems is the relation. Relations enable the construction of a semantic net of objects. These relations are augmented by views that allow a variety of inference techniques. ESA

N88-10554# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON THE MAXIMUM OF SOLUTIONS FOR A SEMILINEAR ELLIPTIC PROBLEM
Guido Sweers 1987 25 p
(Rept-87-08; B8711343; ISSN-0920-8577; ETN-87-90841)
Copyright Avail: NTIS HC A03/MF A01

Existence and uniqueness results in order intervals for an eigenvalue problem were obtained. Results connected with the maximum of solutions of the problem are presented. ESA

N88-10555# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
SMOOTH DYNAMICS ON THE INTERVAL (WITH AN EMPHASIS ON UNIMODAL MAPS)
S. J. vanStrien 1987 71 p
(Rept-87-09; B8709669; ISSN-0920-8577; ETN-87-90842)
Copyright Avail: NTIS HC A04/MF A01

Results on the topological dynamics of unimodal maps are reviewed. Analytic tools to eliminate the condition that the Scharz derivative be negative are surveyed. Nonexistence of wandering intervals; hyperbolicity results; existence of invariant measures; and renormalization results are considered. ESA

N88-10556# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
AN ASYMPTOTIC THEORY FOR A CLASS OF INITIAL-BOUNDARY VALUE PROBLEMS FOR WEAKLY NONLINEAR WAVE EQUATIONS WITH AN APPLICATION TO A MODEL OF THE GALLOPING OSCILLATIONS OF OVERHEAD TRANSMISSION LINES
W. T. vanHorssen 1987 41 p Sponsored by the Netherlands Organization for the Advancement of Pure Research
(Rept-87-12; B8711345; ISSN-0920-8577; ETN-87-90845)
Copyright Avail: NTIS HC A03/MF A01

Asymptotic methods for initial boundary value problems and initial value problems for weakly nonlinear hyperbolic partial differential equations of order two are considered. An asymptotic theory for a class of initial-boundary value problems for weakly nonlinear wave equations is presented. The theory implies the well-posedness of the problem in classical sense and the validity of formal approximations on long time-scales. An initial-boundary value problem for a Rayleigh wave equation is studied using a two-timescale perturbation method. Aeroelastic analysis shows that this initial-boundary value problem may be regarded as a model describing the growth of wind-induced oscillations of overhead transmission lines. ESA

N88-10557# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON THE VOLUME OF A n-DIMENSIONAL SIMPLEX
C. Roos 1987 15 p
(Rept-87-16; B8711348; ISSN-0920-8577; ETN-87-90849)
Copyright Avail: NTIS HC A03/MF A01

A formula for the volume of an n-dimensional simplex, which expresses this volume in terms of the hyperplanes defining the simplex, is presented. ESA

N88-10558# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
COMPUTING THE BOUNDED REGION DETERMINED BY FINITELY MANY LINES IN THE PLANE
Gert Vegter 1987 16 p Sponsored in part by DARPA
(CS-8703; ETN-87-90855) Avail: NTIS HC A03/MF A01

A set of n lines in the plane determines a connected bounded region. An algorithm to compute the polygonal boundary of this region is presented. It runs in time O(n log n), which is optimal. The method used to develop the algorithm also yields a proof of the fact that this polygonal boundary has O(n) vertices. ESA

N88-10559# Illinois Univ., Urbana. Dept. of Computer Science.
S-STEP ITERATIVE METHODS FOR SYMMETRIC LINEAR SYSTEMS
A. T. Chronopoulos and C. W. Gear Jun. 1987 28 p
(Contract DE-FG02-87ER-25026)
(DE87-010819; DOE/ER-25026/6; UILU-ENG-87-1733; UIUCDCS-R-87-1345) Avail: NTIS HC A03/MF A01

This paper introduces the s-step Conjugate Gradient Method for Symmetric and Positive Definite (SPD) linear systems of equations and discusses its convergence and stability properties. In the s-step Conjugate Gradient method iteration s new directions are formed simultaneously from (r/sub i/, Ar/sub i/, ..., A/sup s-1/r/sub i/) and the preceding s directions. All s directions are chosen to be A-orthogonal to the preceding s directions. The approximation to the solution is then advanced by minimizing an error functional simultaneously in all s directions. This intuitively means that the progress towards the solution in one iteration of the s-step method equals the progress made over s consecutive steps of the one-step method. This is proven to be true. DOE

N88-10560# Lawrence Livermore National Lab., Calif.
PARALLEL COMPUTATION OF A DOMAIN DECOMPOSITION METHOD
R. C. Y. Chin, G. W. Hedstrom, J. S. Scroggs, and D. C. Sorensen 1987 8 p Presented at the 6th IMACS International Symposium on Computer Methods for Partial Differential Equations, Bethlehem, Pa., 23 Jun. 1987 Prepared in cooperation with Illinois Univ., Urbana and Argonne National Lab., Ill.
(Contracts DE-FG02-85ER-25001; W-7405-eng-48; W-31109-ENG-38)
(DE87-011444; CONF-870677-8) Avail: NTIS HC A02/MF A01

The most easily tractable multiple scale problems are those in which there are only a small number of widely separated groups of scales and the motion on the fastest scales has little influence on the smooth part of the solution. An identifying feature of this class is the presence of regions in which the solution undergoes rapid variation. Such regions are called boundary or internal layers, depending on whether they are located near a boundary or in the interior of the domain. These are the problems which are most natural for multitasking because it makes sense to break up the domain according to the regions of different local behavior. This paper restricts its attention to this class of multiple scale problems. DOE

N88-10561# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MATHEMATICS APPLIED TO NUCLEAR GEOPHYSICS [MATEMATICA APLICADA A GEOFISICA NUCLEAR]
Enio BuenoPereira and Daniel J. R. Nordemann Jul. 1987 17 p In PORTUGESE Presented at the 2nd Regional Meeting of Applied Mathematics and Computation, Sao Jose dos Campos, Brazil, 18-20 May 1987 Sponsored in part by the National Fund for Scientific and Technologic Research
(INPE-4234-PRE/1109) Avail: NTIS HC A03/MF A01

One of the most powerful tools of nuclear geophysics was the acquisition and interpretation of alpha and gamma radiation spectra. In this work of qualitative measure, the problem of information loss due to noise introduction in the information codification process is discussed. The decodification process should be assisted by an adequate model of system measurement for restoring the information content concerning the nuclear source. Author

N88-10562# Sandia National Labs., Albuquerque, N. Mex.
A NUMERICAL AND ANALYTICAL INVESTIGATION OF RAYLEIGH-TAYLOR INSTABILITY IN A SOLID TUNGSTEN PLATE
A. C. Robinson and J. W. Swegle Jul. 1987 56 p
(Contract DE-AC04-76DP-00789)
(DE87-013593; SAND-87-0766) Avail: NTIS HC A04/MF A01

The Rayleigh-Taylor instability response of an elastic-plastic tungsten plate is investigated by numerical experiments and an approximate modal analysis. The so-called minimum amplitude instability criteria derived from plasticity analyses is shown to be incomplete as a general indicator of instability or stability at very large driving pressures. Model equations are derived which are able to reproduce the basic qualitative features of the observed instability response given by the numerical calculations. DOE

N88-10563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPROXIMATE POLYNOMIAL PRECONDITIONING APPLIED TO BIHARMONIC EQUATIONS ON VECTOR SUPERCOMPUTERS
Yau Shu Wong and Hong Jiang (Alberta Univ., Edmonton.) Oct. 1987 20 p
(NASA-TM-100217; E-3826; NAS 1.15:100217; ICOMP-87-5)
Avail: NTIS HC A03/MF A01 CSCL 12A

Applying a finite difference approximation to a biharmonic equation results in a very ill-conditioned system of equations. This paper examines the conjugate gradient method used in conjunction with the generalized and approximate polynomial preconditionings for solving such linear systems. An approximate polynomial preconditioning is introduced, and is shown to be more efficient than the generalized polynomial preconditionings. This new technique provides a simple but effective preconditioning polynomial, which is based on another coefficient matrix rather than the original matrix operator as commonly used. Author

N88-10564# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
PREDICTION AND SPECTRAL DECOMPOSITION OF WIDE SENSE STATIONARY PROCESSES ON Z SQUARED
Hayri Korezlioglu and P. Loubaton (Thomson-CSF, Gennevilliers, France) May 1987 49 p
(ENST-87C001; ISSN-0751-1337; ETN-87-90654) Avail: NTIS HC A03/MF A01

The half-plane prediction problem for a complex valued process is studied. The results are used for solving the prediction problems corresponding to the lexicographic order and strict and large partial orders. ESA

N88-10565# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
ON PERFECT HASH FUNCTIONS [SUR LES FONCTIONS DE HACHAGE]
Jeannette Janssen Dec. 1986 29 p In ENGLISH; FRENCH summary
(ENST-86D008; ISSN-0751-1345; ETN-87-90657) Avail: NTIS HC A03/MF A01

The combinatorial properties of matrices linked to hash functions are studied. The use of hash functions for information retrieval by table searching is outlined. Practical difficulties in using families of perfect hash functions are reviewed. ESA

N88-10566# Lanchester Polytechnic, Coventry (England). Dept. of Mathematics.
DIVISION ALGEBRAS AND SPHERE FIBRATIONS
H. D. Robinson Mar. 1986 7 p
(ETN-87-90677) Avail: NTIS HC A02/MF A01

A modification of division algebras and fibrations of spheres by great spheres is proved. The fibration is totally geodesic and Riemannian. ESA

N88-10567# Politecnico di Milano (Italy). Dipt. di Elettronica.
THE PERIODIC LYAPUNOV EQUATIONS
Paolo Bolzern and Patrizio Colaneri 1986 36 p
(Rept-86-007; ETN-87-90764) Avail: NTIS HC A03/MF A01

The periodic Liapunov equation, in discrete-time and in continuous-time is reviewed. Necessary and sufficient conditions for the existence and uniqueness of the periodic solutions are given. ESA

N88-10568# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FINITE DIFFERENCE SOLUTION OF A GENERIC DIFFERENTIAL EQUATION Final Report
Paul R. Gagnon 25 Jun. 1987 30 p
(PB87-205878; VPI-E-87-12) Avail: NTIS HC A03/MF A01 CSCL 12A

It is extremely difficult to find the exact solutions of many differential equations which model engineering phenomena. Numerical methods are now being used to find approximate solutions to differential equations which cannot be solved by ordinary mathematical means. A generic differential equation which, depending on its form, can model various engineering phenomena, including sound wave propagation, heat flow, and fluid wave propagation is examined. A finite difference numerical scheme is used to achieve an approximate solution of the equation. Sample cases are presented, and it is seen that valid solutions of the differential equation using a finite difference approach can be obtained. GRA

N88-10569# Bonn Univ. (West Germany). Hohen Mathematisch-Naturwissenschaft Fakultaet.
ERROR ESTIMATES FOR FINITE ELEMENT APPROXIMATIONS OF PARABOLIC VARIATIONAL EQUATIONS Ph.D. Thesis [FEHLERABSCHAETZUNGEN FUER FINITE-ELEMENTE APPROXIMATIONEN VON PARABOLISCHEN VARIATIONSGLEICHUNGEN]
Alfredo Fetter Nathansky, E. Brieskorn, ed., J. Frehse, ed., St. Hildebrandt, ed., F. Hirzebruch, ed., G. Harder, ed., W. Klingenberg, ed., R. Leis, ed., I. Lieb, ed., and E. Peschl, ed. et al. 1987 59 p In GERMAN
(Bonner-Mathe-Schr-179; ETN-87-90557) Avail: NTIS HC A04/MF A01

The convergence of finite element approximations of parabolic variational equations was studied. These equations occur in heat transfer problems and molecular diffusion phenomena. For the numerical solution of the equation, piecewise linear finite elements and the implicit Euler method were used. Regularity characteristics are summarized. Error estimates for two spatial dimensions were made, optimized with respect to the order attainable with linear finite elements and Euler method. Applications of these estimates for the single-phase Stefan problem are given. ESA

N88-10570# Bonn Univ. (West Germany). Hohen Mathematisch-Naturwissenschaft Fakultaet.
SEMIDISCRETE GALERKIN METHOD FOR SEMILINEAR EVOLUTION EQUATIONS WITH A DIFFERENTIAL OPERATOR OF THIRD ORDER Ph.D. Thesis [SEMIDISKRETE GALERKIN-VERFAHREN FUER SEMILINEARE EVOLUTIONSGLEICHUNGEN MIT EINEM DIFFERENTIALOPERATOR DRITTER ORDNUNG]
Holger Schroeder, E. Brieskorn, ed., J. Frehse, ed., St. Hildebrandt, ed., F. Hirzebruch, ed., G. Harder, ed., W. Klingenberg, ed., R. Leis, ed., I. Lieb, ed., and E. Peschl, ed. et al. 1987 126 p In GERMAN
(Bonner-Mathe-Schr-181; ETN-87-90558) Avail: NTIS HC A07/MF A01

Asymptotic error estimates for semidiscrete Galerkin methods for the numerical solution of (semi-)linear evolution equations using finite elements were deduced. The characteristics of the continuous problems (Sobolev space, interpolation characteristics, a priori estimates) are discussed. A Galerkin method with penality term for the Korteweg-Devries (KdV) equation is presented. The smoothing properties of the Galerkin method for problems of third

order are discussed. A dissipative Galerkin method was applied to the KdV-Burgers equation, resulting in an improved convergence. The convergence rates for unsteady initial functions were numerically calculated for the KdV-Burgers equation. Numerical experiments with solitons are shown. ESA

N88-10571# Royal Aircraft Establishment, Farnborough (England).
PROCESSING OF FRACTAL FUNCTIONS BY LINEAR AND NONLINEAR OPERATORS
J. G. Jones Sep. 1985 111 p
(RAE-TR-85079; RAE-Space-650; BR99398; ETN-87-90952)
Copyright Avail: NTIS HC A06/MF A01

A method for predicting the stochastic response of systems, or operators, to fluctuating inputs is presented. The inputs are represented by a multiple-scale model which combines concepts of fractal geometry with a resolution into minimum-uncertainty cells. Associated probability distributions are expressed in terms of generalized or Gibbs energy functions. System, or operator, response may be linear or nonlinear and is evaluated by a functional-integral technique based on the Laplace asymptotic approximation. ESA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N88-10572# Admiralty Research Establishment, Portland (England).
INDEPENDENCE IN SONAR OBSERVATIONS
D. E. Weston Feb. 1987 22 p
(ARE-TR-87102; ACCN-74720; BR102532; ETN-87-90688)
Copyright Avail: NTIS HC A03/MF A01

The effect of correlations on the cumulation of detection probability resulting from several looks is considered. Simple formulas for two pulses and for several pulses, including the case of several pulses obeying a Markov chain process are derived. This allows a consistent account to be given of the detection process, with various critical values for the correlation coefficient. Using the relations between the correlations before and after asymmetrical clipping, the observations are found to be more nearly independent than might initially be thought. ESA

N88-10573# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A PROBLEM IN QUANTUM PROBABILITY
P. Kruszynski 1987 20 p
(Rept-87-06; B8705773; ISSN-0920-2358; ETN-87-90839)
Copyright Avail: NTIS HC A03/MF A01

The necessary and sufficient conditions for a bistochastic matrix P to be regular with respect to bases (phi i) and (psi j) are considered; P phi is the orthogonal projection onto the vector phi of an observable A of a physical system in Hilbert space and (psi, A psi) are the expectation values of A in the system. ESA

N88-10574# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
BREAKDOWN POINTS OF AFFINE EQUIVARIANT ESTIMATORS OF MULTIVARIATE LOCATION AND COVARIANCE MATRICES
Hendrik P. Lopuhaae and Peter J. Rousseuw 1987 33 p
(Grant ZWO-10-62-10)
(Rept-87-14; B8711347; ISSN-0920-8577; ETN-87-90847)
Copyright Avail: NTIS HC A03/MF A01

Maximal finite-sample breakdown points for different classes of estimators of multivariate location and covariance matrices are discussed. It is shown that the upper bound for affine equivariant estimators is attained exactly by the minimum volume ellipsoid estimator, the smooth S-estimators, and by their reweighted versions. ESA

N88-10575# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
IDENTIFICATION OF MULTIVARIATE OUTLIERS AND LEVERAGE POINTS BY MEANS OF ROBUST COVARIANCE MATRICES
Peter J. Rousseuw and Bert C. vanZomeren 1987 27 p
(Rept-87-15; B8709671; ISSN-0920-8577; ETN-87-90848)
Copyright Avail: NTIS HC A03/MF A01

A high-breakdown location estimator called the minimum volume ellipsoid estimator is presented. It is the center of the minimal volume ellipsoid covering at least half of the observations. The corresponding robust covariance estimator is given by the minimum volume ellipsoid itself. The method is implemented in a portable FORTRAN program. It is shown that the algorithm, based on a resampling scheme which resembles that used in least median of squares regression, is able to identify outliers in multidimensional space. By applying the method to the independent variables of a regression data set it is also possible to identify leverage points. ESA

N88-10576# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics
PROGRESS: A PROGRAM FOR ROBUST REGRESSION ANALYSIS ON THE IBM PC
A. Leroy (Vrije Universiteit, Brussels, Belgium) and P. Rousseuw 1985 60 p
(Rept-85-14; ETN-87-90852) Copyright Avail: NTIS HC A04/MF A01

The least median of squares (LMS) regression technique designed to lessen the impact of outliers is introduced. The residuals resulting from the LMS regression coefficients are used to assign a weight to each observation. Points with zero weight can then be identified as outliers. These weights are then used to calculate the corresponding reweighted least squares estimate (that is, least squares applied to the points with weight one). An algorithm for this robust regression method was implemented in FORTRAN. Output consists of results concerning LS, LMS, and reweighted LS based on the LMS. It gives the regression coefficients with their standard deviations and T-value, their variance-covariance matrix, an estimate for the scale parameter, the determination coefficient (R squared), the standardized residuals, and residual plots of two types (in order to identify the outliers in an easy way, and to detect possible inadequacies of the model). ESA

N88-10577# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
PASSAGE FROM TWO-PARAMETERS TO INFINITE DIMENSION
Hayri Korezlioglu May 1987 26 p Presented at the Conference on Stochastic Partial Differential Equations, Trente, Italy, 30 Sep.-5 Oct. 1985 Submitted for publication
(ENST-87C002; ISSN-0751-1337; ETN-87-90655) Avail: NTIS HC A03/MF A01

The transition probabilities of bidirectional Markov processes are constructed in function spaces and an Ito formula for a class of bidirectional diffusions considered as infinite dimensional processes is given. It is shown how the filtering problem of these diffusions can be formulated in function spaces. ESA

N88-10578# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
WHITE NOISE CALCULUS FOR TWO-PARAMETER FILTERING
G. Kallianpur and Hayri Korezlioglu May 1987 12 p Presented at the Fifth IFIP Working Conference on Stochastic Differential Systems, Eisenach, West Germany, 6-13 Apr. 1986 Submitted for publication
(ENST-87C003; ISSN-0751-1337; ETN-87-90656) Avail: NTIS HC A03/MF A01

The white noise calculus for the filtering of two-parameter processes having a Markov property with respect to left and/or lower half planes is introduced. The linear case is treated using

an approach derived from the nonlinear case. The horizontal filtering problem is brought to that considered in the optimum filter in finitely additive nonlinear filtering theory, with an observation noise taking its values in a Hilbert space. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N88-10579# Sandia National Labs., Albuquerque, N. Mex.
A COMPARISON OF OPEN AND CLOSED MULTIMEGAWATT SPACE POWER AND WEAPON SYSTEMS
D. R. Gallup and M. W. Edenburn 1987 12 p Presented at the 4th Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 12 Jan. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012975; SAND-87-0637C; CONF-870102-28) Avail: NTIS HC A03/MF A01

One of the major questions that is being addressed at present by Strategic Defense Initiative's Multimegawatt Space Power Project is whether or not space weapon power systems must be closed, i.e., whether effluents from the systems are tolerable. If they are not tolerable, the major penalty that must be paid to close space systems is increased mass. Open systems remove waste heat by producing effluents, e.g., hot hydrogen gas. Closed systems require radiators, thermal storage masses, effluent storage, or refrigeration to remove waste heat. The mass penalty incurred by addition of these devices is so severe that the option of closing space power systems should be avoided, if at all possible. The mass penalty is even more severe if the weapon system itself must also be closed. DOE

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N88-10580# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
STOCHASTIC INTEGRATION FOR OPERATOR VALUED PROCESSES ON HILBERT SPACES AND ON NUCLEAR SPACES
Hayri Korezlioglu and Claude Martias May 1987 58 p
(Contract F49620-82-C-0009)
(ENST-87D002; ISSN-0751-1345; ETN-87-90659) Avail: NTIS HC A04/MF A01

The representation of a nuclear space valued square integrable martingale by another nuclear space valued square integrable martingale is given in terms of stochastic integrals of operator valued processes. The construction of the stochastic integral goes through that of operator valued processes on Hilbert spaces. An approach for the Hilbertian case, so that only the integration of Hilbert-Schmidt operator valued processes is needed to represent square integrable martingales is given. ESA

N88-10581# Technische Univ., Berlin (West Germany). Fachbereich Mathematik.
SPECTRAL AND STRUCTURAL PROPERTIES OF NONNEGATIVE REDUCIBLE OPERATORS IN BANACH RELATIONS Ph.D. Thesis [SPEKTRAL- UND STRUKTUREIGENSCHAFTEN NICHTNEGATIVER REDUZIBLER OPERATOREN IN BANACH-VERBAENDEN]
Johanna Koelsche 1987 109 p In GERMAN
(ETN-87-90402) Avail: NTIS HC A06/MF A01

Eigenvalues of a nonnegative linear operator T with compact exponent in a Banach relation were characterized, and necessary and sufficient conditions for the existence of nonnegative solutions of linear equations with T were deduced. This was done using the spectral properties of the compressions of T on maximum irreducible bands whose spectral radii are positive. The introduction of these bands leads to structural representations of T. The structural properties of reducible operators were used to deduce necessary and sufficient conditions for the existence of nonnegative eigenvectors of the spectral radius of T, which are quasi-internal points in E. A special basis of the generalized eigenspace of the spectral radius of T was constructed, and the Riesz index of the spectral radius of T was determined. ESA

N88-10582# Technische Univ., Berlin (West Germany). Fachbereich Mathematik.
VOLUME FUNCTIONS IN THE GENERAL THEORY OF RELATIVITY Ph.D. Thesis [VOLUMENFUNKTIONEN IN DER ALLGEMEINEN RELATIVITAETSTHEORIE]
Jan Dieckmann 1987 86 p In GERMAN
(ETN-87-90408) Avail: NTIS HC A05/MF A01

The idea of Geroch to define so-called volume functions on a space-time continuum was investigated. It is shown that there exists for each space-time a finite Borel set with the characteristic that open quantities have a positive size, and that for each point of the topological boundary its causal past and future are a zero quantity. Future and past volume functions on a space-time can be explained by such a set. These functions are semicontinuous. The set of their discontinuity points is the junction of null geodetic lines. The causality conditions chronological, causal, distinctive, strongly causal, steady causal, causally continuous, and globally hyperbolic, can be characterized using volume functions. Using volume functions, it is shown that each globally hyperbolic space-time has a Cauchy plane, which is a three-dimensional, connected, space-like manifold. ESA

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N88-10583# Los Alamos National Lab., N. Mex.
ACCELERATION TO HYPERVELOCITIES USING MINIMUM ENERGY CONCEPTS
G. Marklin Jun. 1987 4 p Presented at the 8th US Symposium on Compact Toroid Research and the 9th US/Japan Workshop on Compact Toroids, College Park, Md., 4 Jun. 1987
(Contract W-7405-eng-36)
(DE87-011796; LA-UR-87-1846; CONF-870631-2) Avail: NTIS HC A02/MF A01

Experiments have begun at Los Alamos to assess the potential of using spheromaks to transfer energy from large, slow moving metal walls to much smaller, faster moving less massive walls so as to achieve hypervelocities in the 20 to 60 km/s range. A large plate transfers energy to the spheromak during a slow compression. The spheromak then releases this energy in a much shorter time to the small plate, accelerating it to much higher velocity. It has been estimated that velocity gains in excess of 4 (V/sub final/yields 20 km/s) can be achieved in a practical single stage experiment. DOE

N88-10584# Los Alamos National Lab., N. Mex.
DIFFERENT WAYS OF LOOKING AT THE ELECTROMAGNETIC VACUUM
P. W. Milonni 1987 33 p Presented at the Adriatico Research Conference on Vacuum in Nonrelativistic Matter-Radiation Systems, Trieste, Italy, 1 Jul. 1987
(Contract W-7405-eng-36)
(DE87-013150; LA-UR-87-2315; CONF-870785-1) Avail: NTIS HC A03/MF A01

Some thoughts on the electromagnetic vacuum are presented in connection with the vacuum and source fields as alternative physical bases for understanding spontaneous emission, the Lamb shift, Casimir effects, van der Waals forces, and the thermalization

of vacuum fluctuations for a uniformly accelerated observer.
DOE

N88-10585# Kiruna Geophysical Inst. (Sweden).
EVIDENCE OF A NEW SPECTRAL LINE INTENSITY FORMULA FOR OPTICAL EMISSION
Sten Yngstroem and Bo Thelin Jun. 1987 31 p Submitted for publication
(KGI-Preprint-098; ETN-87-90739) Avail: NTIS HC A03/MF A01

Experimental evidence of an intensity formula in optical emission spectroscopy based on two methods of data analysis is presented. The mathematical foundation of analysis of the fluctuations in data of repeatedly measured line intensities is presented. The method is applied to data from various spectral lamps and yields strong support of the formula. Tabulated standard values of absolute intensities of a great number of spectral lines are shown to be in excellent agreement with the formula. It is suggested that the two methods of analysis can be useful in spectrochemical research for identification of spectral lines and determination of atomic transition rates. The significance of the formula in relation to Planck's black body radiation law is discussed. ESA

N88-10586# National Bureau of Standards, Gaithersburg, Md. Office of Physical Measurement Services.
NBS (NATIONAL BUREAU OF STANDARDS) CALIBRATION SERVICES USERS GUIDE: FEE SCHEDULE
Apr. 1987 78 p
(PB87-210654; NBS/SP-250/A) Avail: NTIS HC A05/MF A01 CSCL 20C

The physical measurement services of the National Bureau of Standards are designed to help the makers and users of precision instruments achieve the highest possible levels of measurement quality and productivity. The hundreds of individual services found listed in the Fee Schedule constitute the highest-order calibration services available in the United States. These services directly link a customer's precision equipment or transfer standards to national measurement standards. These services are offered to public and private organizations and individuals alike. The Fee Schedule is a supplement to NBS Special Publication 250, Calibration Services Users Guide. These documents are designed to make the task of selecting and ordering an appropriate calibration service as quick and easy as possible. GRA

N88-10587# Lawrence Livermore National Lab., Calif.
RESPONSE OF HELICAL STRUCTURES TO HIGH SPEED PULSES OR WHEN CAN A HELIX BE CALLED AN INDUCTOR
M. S. DiCapua, N. E. Molau, and P. C. Wheeler 29 Jun. 1987 7 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987
(Contract W-7405-eng-48)
(DE87-014347; UCRL-96264; CONF-870656-46) Avail: NTIS HC A02

Vacuum and dielectric cored loosely wound helices are widely used in pulse power systems. In one extreme, when the applied pulse length is shorter then the transit time in the helix, helices are used as transit time isolators, to lead signals from high voltage terminals to ground. In the other extreme, for pulse durations that are much longer than the transit time, helices act as conventional inductors and are used for high frequency isolation or as shields for trigger, signal or gas leads to pulse power components. In either case, the use of helices in the presence of fast pulses requires an understanding of their behavior in regimes where time delays associated with wave propagation in the helix are not negligible when compared to the length or risetime of the applied pulse and hence their description as lumped elements is no longer correct. This paper describes the results of analytical approximations, circuit simulations, 3-D time dependent electromagnetic modeling as well as laboratory measurements on helices surrounded by conducting structures. On the basis of these investigations their suitability as voltage measuring devices will be discussed. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N88-10588# Air Force Occupational and Environmental Health Lab., Brooks AFB, Tex.
FIRST ARTICLE TEST NOISE SURVEY OF THE A/F32T-9 LARGE TURBO FAN ENGINE ENCLOSED NOISE SUPPRESSOR SYSTEM, SKY HARBOR IAP (INTERNATIONAL AIRPORT), PHOENIX, ARIZONA Final Report, for Period Ending Nov. 1986
Jeffery C. Jenkins and Terry M. Fairman Jun. 1987 160 p
(AD-A183799; USAFOEHL-87-082EH0186FNA) Avail: NTIS HC A08/MF A01 CSCL 20A

The A/F32T-9 Large Turbofan Engine, Enclosed Noise Suppressor System (T-9 NSS) at Sky Harbor International Airport, Phoenix, Arizona was surveyed to determine noise levels at 100 meters. With an F101 engine operating at afterburner power the highest measured Overall Sound Level, A-Weighted (OASLA) was 88.7 dB(A). The measured OASLA values exceeded the 77 dB(A) criterion at all but five of the twenty-four sampling positions.
GRA

N88-10589# Southampton Univ. (England). Inst. of Sound and Vibration Research.
[ACTIVITIES REPORT OF THE INSTITUTE OF SOUND AND VIBRATION RESEARCH] Annual Report, period ending Mar. 1987
1987 49 p
(ETN-87-90685) Avail: NTIS HC A03/MF A01

Research concerning fluid dynamics and acoustics; audiology and human effects; structures and machinery; and signal processing and control is summarized. Aircraft noise; underwater acoustics; silencers; biomechanics; noise measurement; hearing; structural dynamics; laser technology; automotive engineering; and active control are discussed. ESA

N88-10590# Royal Aircraft Establishment, Farnborough (England).
A NEW METHOD FOR DETERMINING ACOUSTIC PROPERTIES OF THE SEABED FROM THE AMBIENT NOISE FIELD IN THE OCEAN
M. J. Buckingham and S. A. S. Jones Feb. 1986 25 p
(RAE-TR-86035; RAE-Rad-Nav-145; BR100397; ETN-87-90699)
Copyright Avail: NTIS HC A03/MF A01

It is shown that by measuring the noise power distribution in the vertical, the critical grazing angle of the ocean bottom (alpha C) can be determined and hence the compressional sound speed in the bottom sediment deduced. The ambient noise vertical directionality was measured at six sites using specially designed vertical line-array sonobuoys. The critical grazing angle and the sound speed in the bottom were estimated from the noise data for all six areas. Similar data from independent seismic surveys are available for one of the sites. For this area the independent estimate of alpha C (28 deg) compares closely with the result obtained from the noise technique (26.2 deg). ESA

N88-10591# Ames Lab., Iowa.
MEASUREMENT OF AGGLOMERATE STRENGTH DISTRIBUTIONS IN AGGLOMERATED POWDERS Ph.D. Thesis
M. Ciftcioglu Aug. 1987 166 p
(Contract W-7405-eng-82)
(DE87-013605; IS-T-1325) Avail: NTIS HC A08/MF A01

A new technique for measuring the strength distributions of powder agglomerates involves the use of a calibrated ultrasonic sound field. Agglomerate strength distributions were measured for a variety of yttria and yttria-stabilized zirconia powders. Different preparation methods were used to obtain powders containing agglomerates with different characteristics. Special yttria powders containing agglomerates of 0.1 microns, spherical, monosize spheres were also prepared. BET surface area, tap density, pressed density, compaction curves, and mercury intrusion curves were also obtained. The powders were pressed and sintered, and the

sintered density measured for each pellet. Smooth curves could be drawn when agglomerate strength was plotted against sintered density; the sintered density of the powders also could be ranked directly according to the strength of the agglomerates in each powder. Except for the model yttria powders containing monosize spherical particles, there was no correlation between sintered density and any other measured powder parameter. For this model powder, most of measured powder parameters correlated directly with sintered density, in almost textbook fashion. It was also possible, using these model powders, to isolate the effect of agglomerate strength on sintered density by holding all other powder characteristics constant. DOE

N88-10592*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE OF A MODEL HIGH SPEED COUNTERROTATION PROPELLER AT SIMULATED TAKEOFF/APPROACH CONDITIONS (F7/A7)
Richard P. Woodward 1987 25 p Presented at the 11th Aeroacoustics Conference, Sunnyvale, Calif., 19-21 oct. 1987: sponsored by AIAA
(NASA-TM-100206; E-3766; NAS 1.15:100206; AIAA-87-2657)
Avail: NTIS HC A03/MF A01 CSCL 20A

A high speed advanced counterrotation propeller, was tested in the NASA-Lewis 9 x 15 foot Anechoic Wind Tunnel at simulated takeoff/approach conditions of 0.2 Mach number. Acoustic measurements were taken with fixed floor microphones, an axially translating microphone probe, and with a polar microphone probe which was fixed to the propeller nacelle and could take both sideline and circumferential acoustic surveys. Aerodynamic measurements were also made to establish the prcpeller operating conditions. The propeller was run over a range of blade setting angles from 36.4/36.5 to 41.1/39.4 deg, tip speeds from 165 to 259 m/sec, rotor spacings from 1.56 to 3.63 based on forward rotor tip chord to aerodynamic separation, and angles of attack to + or - 16 deg. First order rotor alone tones showed highest directivity levels near the propeller plane, while interaction tone showed high levels throughout sideline directivity, especially toward the propeller rotation axis. Interaction tone levels were sensitive to propeller row spacing while rotor alone tones showed little spacing effect. There is a decreased noise level associated with higher propeller blade numbers for the same overall propeller thrust. Author

N88-10593# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ACTIVE MINIMISATION OF ACOUSTIC FIELDS. A REVIEW OF RESEARCH INTO THE ACTIVE CONTROL OF SOUND UNDERTAKEN AT ISVR FROM 1983 TO 1986
P. A. Nelson and S. J. Elliott May 1987 82 p Presented at the Euromech Colloqium 213, Marseille, France, Sep. 1986 Submitted for publication Sponsored by the UK Dept. of Trade and Industry
(ISVR-TR-146; ETN-87-90684) Avail: NTIS HC A05/MF A01

Quadratic optimization theory is shown to be useful for problems associated with the active control of sound. The theory is used in establishing the absolute physical limits of the ability of arrays of discrete secondary sources to suppress or absorb free field acoustic radiation. The problem of controlling enclosed sound fields is dealt with. The same theoretical basis is also used to describe multichannel systems for the complementation of active control and a class of adaptive control algorithms is introduced. ESA

N88-10594 National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
NOISE LEVELS FROM PROPELLER-DRIVEN AIRCRAFT MEASURED AT GROUND LEVEL AND AT 1.2 m ABOVE THE GROUND
R. C. Payne Mar. 1987 63 p
(NPL-AC-110; ISSN-0143-7143; ETN-87-90931) Copyright
Avail: Issuing Activity

Aircraft noise measurements using microphones close to the ground plane and at a height of 1.2 m showed substantial differences between measured A-weighted sound levels. The differences depend on ground cover, aircraft type, and flight maneuver. The ground-plane microphones produced A-weighted levels which closely approximate to pressure-doubled values. Two procedures for correcting A-weighted sound pressure levels measured 1.2 m above the ground, to obtain pressure-doubled levels, were examined. In one procedure the noise spectrum was assumed to be represented by a series of 1/3-octave bands, in the other by a number of pure tones or discrete narrow-bands of noise. Neither correction procedure is wholly successful. It is concluded that, to avoid significant variations in measured A-weighted levels, noise measurements must be made using a ground-plane microphone. ESA

N88-10595# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
NOISE EMISSION OF CIVIL AND MILITARY AERO-ENGINES. SOURCES OF GENERATION AND MEASURES FOR ATTENUATION
H. Grieb and K. Heinig Sep. 1986 25 p Presented at the NATO Symposium on Aircraft Noise in the Modern Society, Mittenwald, West Germany, 22-25 Sep. 1986
(ETN-87-91021) Avail: NTIS HC A03/MF A01

It is shown that noise reduction on high bypass ratio turbofans for civil airliners is well established. The noise levels achieved meet the internationally agreed regulations (FAR 36). The same holds true for large military transport aircraft. Helicopter noise is caused essentially by the main and tail rotors. Noise reduction on afterburner and dry engines for combat and strike aircraft, which represent the major noise annoyance to the public, is very difficult because: high specific thrust is mandatory for aircraft performance and effectiveness; jet noise with and without afterburning is predominant; and the design of the reheat section and final (variable) nozzle in practice precludes the application of known concepts for jet noise attenuation in dry and reheated operation. ESA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N88-10596# Materials Research Labs., Melbourne (Australia).
AN INTERACTIVE COMPUTER PROGRAM FOR MATERIALS ANALYSIS BY MEANS OF ION SCATTERING
J. W. Butler (Naval Research Lab., Washington, D.C.) Jan. 1987 72 p
(MRL-R-1040; AR-005-113) Avail: NTIS HC A04/MF A01

The theory and operation of a program for analyzing the data obtained by the scattering of high-energy ions from a sample whose elemental depth concentration profiles are desired, are described. The region so analyzed is from the surface to depths about three microns, with a depth resolution of about 30 nm near the surface. The program, written in an enhanced BASIC system language for a desktop computer, is designed for users who are specialists in materials science. The program is highly interactive in the following ways: the user exerts direct control over program flow by means of event-initiated branching; the computer communicates with the user at the user's natural level rather than at the computer's natural level; and about 99 percent of the program lines are dedicated to input/output operations and error inhibition and handling. Detailed graphics and on-screen editing capabilities, designed specifically for the problem at hand, are integrated with the mathematical capability into a unified, single-context program. The user interates the editing of the sample composition matrix and the comparison of calculated and experimental energy spectra for the scattered ions until a satisfactory level of fit is obtained, at which time the composition matrix is deemed to be an acceptable representation of the sample and may be printed and plotted as the ultimate goal and output of the operation. An annotated listing of the program is appended. Author

N88-10597 Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany).
MONTE CARLO CALCULATIONS FOR THE SIMULATION OF CHANNELING EXPERIMENTS ON IRRADIATED ALUMINUM ALLOYS. CALCULATION OF ANGLE-DEPENDENT EFFICIENCY CURVES
M. Mueller Aug. 1986 111 p In GERMAN; ENGLISH summary
(HMI-B-433; ETN-87-90385) Copyright Avail: Issuing Activity

The channeling process was simulated by Monte Carlo calculations, for the application of the channeling technique for the location of solute atoms in irradiation-produced mixed dumbbells of aluminum alloys. The collisions of the channeled ions with the nearest target atoms were taken into account in the Monte Carlo calculations by a momentum approximation. Flux distributions as a function of the angle of incidence were determined. Figures representing planar angular yields of the ions backscattered from solute atoms in mixed dumbbells of different concentrations are presented. On the basis of these curves the positions of the Mn, Ag, Cu, Ge, and Zn atoms in mixed dumbbells of aluminum alloys can be determined from experimental scans. ESA

N88-10598# Los Alamos National Lab., N. Mex.
AB INITIO METHODS FOR ELECTRON-MOLECULE COLLISIONS
L. A. Collins and B. I. Schneider 1987 26 p Presented at the 15th International Conference on the Physics of Electronic and Atomic Collisions, Brighton, England, 22 Jul. 1987
(Contract W-7405-eng-36)
(DE87-011728; LA-UR-87-2249; CONF-870715-1) Avail: NTIS HC A03/MF A01

This review concentrates on the recent advances in treating the electronic aspect of the electron-molecule interaction and leaves to other articles the description of the rotational and vibrational motions. Those methods which give the most complete treatment of the direct, exchange, and correlation effects are focused on. Such full treatments are generally necessary at energies below a few Rydbergs (approx. = 60 eV). This choice unfortunately necessitates omission of those active and vital areas devoted to the development of model potentials and approximate scattering formulations. The ab initio and model approaches complement each other and are both extremely important to the full explication of the electron-scattering process. Due to the rapid developments of recent years, the approaches that provide the fullest treatment are concentrated on. DOE

N88-10599# Tri-Univ. Meson Facility, Vancouver (British Columbia).
THE ELASTIC SCATTERING OF INTERMEDIATE ENERGY PROTONS FROM (40)Ca AND (208)Pb
D. A. Hutcheon, W. C. Olsen, H. S. Sherif, R. Dymarz, J. M. Cameron, J. Johansson, P. Kitching, P. R. Liljestrand, W. J. McDonald (Alberta Univ., Calgary.), and C. A. Miller et al. [1987] 63 p
Avail: NTIS HC A04/MF A01

The elastic scattering of protons from Ca-40 and Pb-208 has been studied using the MRS facility at TRIUMF. Cross section and analyzing power (A sub y) angular distributions to 50 deg in the center-of-mass have been measured for incident proton energies of 200, 300, 400, and 500 MeV. Comparisons of the experimental results are made with calculations based on relativistic and non-relativistic phenomenological models, and with relativistic and non-relativistic microscopic models. The differences between the results of the non-relativistic and relativistic models manifest themselves in the spin observables. They are found to be smaller in the phenomenological approach than in the microscopic one and they depend on energy. Author

N88-10600# Stockholm Univ. (Sweden). Inst. of Physics.
THE OPTIMUM ILLUMINATION CONDITIONS FOR EXELFS STUDIES IN A CTEM
Z. Xu, S. Csillag, H. Haakansson, and N. Ruus May 1987 17 p
(USIP-87-08; ETN-87-90751) Avail: NTIS HC A03/MF A01

Z. Xu, S. Csillag, H. Haakansson, and N. Ruus May 1987 17 p
(USIP-87-08; ETN-87-90751) Avail: NTIS HC A03/MF A01

By attaching an electron energy analyzer to a Conventional Transmission Electron Microscope (CTEM), electron energy loss and Extended Energy Loss Fine Structure (EXELFS) spectra were obtained. The sample illumination system for these measurements should be operated under quite different conditions from the conventional transmission or the scanning transmission electron microscopy mode. The optimum excitation conditions of the first and second condenser lens together with the objective lens in the image mode are investigated for an optimum carbon k-edge detection. It is demonstrated that the specimen position in the objective lens greatly influences the intensity and energy resolution of the energy loss edge. The optimum specimen position in the objective lens was determined. ESA

N88-10601# Stockholm Univ. (Sweden). Inst. of Physics.
INSTRUMENTAL AND OPERATIONAL ASPECTS OF AN EXELFS SYSTEM CONNECTED TO JEOL 100C STEM
Z. Xu, S. Csillag, H. Haakansson, and N. Ruus May 1987 17 p
(USIP-87-09; ETN-87-90752) Avail: NTIS HC A03/MF A01

An energy loss spectrometer system for Extended Energy Loss Fine Structure (EXELFS) was designed to fit a Scanning Transmission Electron Microscope (STEM). Together with attachments, such as the scanning image display device, computer system with sequential processor, and a photodiode array based detection system, a complete instrument for EXELFS experiments was constructed. The design components and interfaces between components are illustrated, the operation of the system is stated step by step, and the parallel detection method is outlined. ESA

N88-10602# Stockholm Univ. (Sweden). Inst. of Physics.
SUMMARY AND CONCLUSIONS OF THE 6TH MORIOND WORKSHOP
C. Jarlskog May 1987 14 p Sponsored by the Swedish National Research Council
(USIP-87-11; ETN-87-90754) Avail: NTIS HC A03/MF A01

Direct measurements of the neutrino mass; double beta decay and majorans; solar neutrinos; dark matter; nucleon instability; exotic theory; exotic particles; the mirror symmetries C, P, and T; and cosmic rays and Cygnus X-3 are discussed. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N88-10603# Stanford Linear Accelerator Center, Calif.
OPEN ACCELERATING STRUCTURES
R. B. Palmer Dec. 1986 13 p Presented at the Symposium on Advanced Accelerator Concepts, Madison, Wis., 21 Aug. 1987 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(Contract DE-AC03-76SF-00515)
(DE87-010540; SLAC-PUB-4161; CONF-870891-1) Avail: NTIS HC A03/MF A01

An Open Accelerating Structure must first perform the mode matching function of any accelerating structure, i.e., it must couple an incoming free field to an accelerating mode. The simplest open periodic structure that can be considered is a grating. There has been an attempt to employ an inverse Purcell effect by illuminating a grating from directly above with plane parallel light and passing the particles over the surface of the grating at right angles to the lines. Unfortunately, it has been shown by the Lawson theorem that these geometries fail to accelerate relativistic particles. This paper will restate Lawson's theorem but show that it applies only to the simple two-dimensional situation. It is shown that accelerating fields above grating can be made to fall off exponentially from that surface. Several structures are examined that deal with the problem of fields spreading over the whole grating surface. DOE

N88-10604# Stanford Linear Accelerator Center, Calif.
CHANNELED PARTICLE ACCELERATION BY PLASMA WAVES IN METALS
P. Chen and R. J. Noble Jan. 1987 5 p Presented at the Workshop on Relativistic Channeling Acquafredda Di Maratea, Maratea, Italy, 31 Mar. 1986 Prepared in cooperation with Fermi National Accelerator Lab., Batavia, Ill.
(Contract DE-AC03-76SF-00515)
(DE87-010541; SLAC-PUB-4187; SLAC/AP-55; CONF-8603114-4) Avail: NTIS HC A02/MF A01

A solid state accelerator concept utilizing particle acceleration along crystal channels by longitudinal electron plasma waves in a metal is presented. Acceleration gradients of order 100 GV/cm are theoretically possible. Particle dechanneling due to electron multiple scattering can be eliminated with a sufficiently high acceleration gradient. Plasma wave dissipation and generation in metals are also discussed. DOE

N88-10605# Argonne National Lab., Ill.
FAST CRITICAL EXPERIMENT DATA FOR SPACE REACTORS
P. J. Collins, H. F. McFarlane, D. N. Olsen, C. A. Atkinson, and J. R. Ross 1987 5 p Presented at the 4th Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 12 Jan. 1987
(Contract W-31-109-eng-38)
(DE87-007005; CONF-870102-12) Avail: NTIS HC A02/MF A01

Data from a number of previous critical experiments exist that are relevant to the design concepts being considered for SP-100 and MMW space reactors. Although substantial improvements in experiment techniques have since made some of the measured quantities somewhat suspect, the basic criticality data are still useful in most cases. However, the old experiments require recalculation with modern computational methods and nuclear cross section data before they can be applied to today's designs. Recently, we have calculated about 20 fast benchmark critical experiments with the latest ENDF/B data and modern transport codes. These calculations were undertaken as a part of the planning process for a new series of benchmark experiments aimed at supporting preliminary designs of SP-100 and MMW space reactors. DOE

N88-10606# Lawrence Livermore National Lab., Calif.
LINEAR EMITTANCE DAMPER WITH MEGAGAUSS FIELDS
W. A. Barletta 3 Jul. 1987 7 p Presented at the Workshop on New Developments in Particle Acceleration Techniques, Orsay, France, 29 Jun. 1987
(Contract W-7405-eng-48)
(DE87-013562; UCRL-96947; CONF-8706147-2) Avail: NTIS HC A02/MF A01

The emittance of the beams in both high energy, electron-positron colliders and synchrotron light sources is limited by collective beam interactions with the structure of the damping (or storage) rings. A novel linear damper offers the possibility of reducing the emittance by another factor of a few. The underlying physical principle is that high energy, high current, low emittance beams can emit copious hard gammas as synchrotron radiation and cool in the presence of megagauss magnetic fields. These fields can be provided by the beam itself in the presence of a low density gas. DOE

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N88-10607*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Electrical Engineering.
MID INFRARED LHS SYSTEM PACKAGING USING FLEXIBLE WAVEGUIDES Final Report, 1 Oct. 1984 - 15 Aug. 1987
Chung Yu 13 Oct. 1987 132 p
(Grant NAG1-407)
(NASA-CR-181192; NAS 1.26:181192) Avail: NTIS HC A07/MF A01 CSCL 20F

As mid IR fiber optic systems are rapidly approaching a reality, so is the feasibility of fiber optic laser heterodyne systems. Laser heterodyne spectroscopy for high resolution monitoring of atmospheric gaseous pollutants is necessarily in the mid IR, the region in which the absorption signature of gaseous species is most prominent. It so happens that the lowest theoretical loss due to Rayleigh-Brillouin scattering also lies in the mid IR. Prospects of highly efficient laser heterodyne systems are thus very good. Such fibers are now beginning to be commercially available, and a test program is being conducted for such fibers with ambient temperature ranging from cryogenic to above room, and stringest mechanical flexibility requirements. Preliminary results are encouraging. A program is being started to explore the possibility of mid IR fiber optic device applications, by taking advantage of this phonon rich region. The potential long interaction length in fibers coupled with predicted extremely low losses point to stimulated Brillouin scattering based devices in the mW range. The generation of backscattered sBs at low laser powers is significant not only as an ultimate power limiting factor for laser transmission in fibers in the mid IR, but also the presence of frequency-shifted multiple order sBs Stokes and antiStokes lines will certainly have severe effect on the laser beats crucial in high resolution heterodyne spectroscopy. Author

N88-10608# NKF Engineering, Inc., Reston, Va.
FIBER OPTIC ENGINEERING SENSOR SYSTEM. PRELIMINARY PROGRAM MANAGEMENT PLAN, PHASE 3 REVISION
Jul. 1987 36 p
(Contract N00014-87-C-2032)
(AD-A183663; NKF-87103-003/03-Rev) Avail: NTIS HC A03/MF A01 CSCL 17E

The principal objective of this program is to develop a Fiber Optic Engineering Sensor System (FOESS) including sensors, telemetry, and displays for applications such as damage control, system control (i.e., propulsion or steering) and intrusion defense systems for ship, aircraft and shore applications. This objective is being achieved by research and engineering effort conducted in three, originally four, contractually defined phases. GRA

N88-10609# Hochschule der Bundeswehr, Hamburg (West Germany). Fachbereich Maschinenbau.
AN OPTOELECTRONIC ALIGNMENT TELESCOPE FOR STRAIGHTNESS MEASUREMENTS Ph.D. Thesis [EIN ELEKTROOPTISCHES FLUCHTFERNROHR ZUR GERADHEITSMESSUNG]
Claus H. Linhart Dec. 1985 190 p In GERMAN
(ETN-87-90383) Avail: NTIS HC A09/MF A01

An optoelectronic measuring method for straightness tests in machine construction is presented. The general problems of straightness measurements and alignment verification, and the applied testing methods are outlined. The proposed optoelectronic system can be widely used as a mobile comparative measuring system as well as permanently in machines (integrated in process controls) due to its simple functional principle, modular construction, and simple handling. The measuring principle is experimentally demonstrated, and the systematic deviations were determined. ESA

N88-10610# British Aerospace Aircraft Group, Preston (England). Maths Services Dept.
THE DEVIATION OF LIGHT RAYS PASSING THROUGH A CURVED WINDSCREEN
S. Whittle 12 Jan. 1987 20 p
(BAe-MSC.115; ETN-87-90680) Copyright Avail: NTIS HC A03/MF A01

Formulas for the deviation of light rays passing through the windscreen of a fighter aircraft are obtained. The collimation of the head up display can then be altered so that the display does not appear further away than the ground. ESA

N88-10611*# California Univ., Berkeley. Radio Astronomy Lab.
OPTICAL SPECTROSCOPY OF IRAS SOURCES WITH INFRARED EMISSION BANDS. 1: IRAS 21282+5050 AND THE DIFFUSE INTERSTELLAR BANDS Semiannual Status Report, 31 May - 30 Nov. 1987
Martin Cohen and B. F. Jones (Lick Observatory, Santa Cruz, Calif.) 1987 25 p
(Contract NCC2-142)
(NASA-CR-181387; NAS 1.26:181387) Avail: NTIS HC A03/MF A01 CSCL 20F

Spectroscopy of the starlike optical counterpart to IRAS 21282+5050, a source with the hydrocarbon infrared emission band spectrum, shows an 07(f)-(WC11) planetary nebula nucleus suffering an extinction of 5.7 mag. Emission line widths in the WC spectrum are only approx. 100 km/s, indicating a very slow stellar wind. Optical diffuse interstellar bands (DIBs) are prominent. Five DIBs are strongly enhanced, namely lamda lamda 5797, 6196, 6203, 6283, and 6613. The presence of circumstellar hydrocarbon molecules may explain both the infrared emission bands and the enhanced DIBs. Author

N88-10612# Lawrence Livermore National Lab., Calif.
THE USE OF FIBER OPTICS IN THE DETERMINATION OF TEMPERATURE AND EXTENT OF REACTION IN DETONATING EXPLOSIVES
R. Simpson, F. Helm, and J. Kury Jun. 1987 7 p Presented at the Society of Photo-Optical Instrumentation Engineers Conference, Orlando, Fla., 17 May 1987
(Contract W-7405-eng-48)
(DE87-012632; UCRL-96803; CONF-870584-9) Avail: NTIS HC A02

A four-channel fiber optic radiometer has been built to measure the temperature and extent of reaction of a detonation before the shock wave destroys the collection optics. The system is designed to be calibrated both in terms of the relative radiant response and the absolute sensitivity of each channel. Fiber optics and associated data acquisition electronics allow synchronization of radiometric and pressure transducer signals to under 10 nsec. DOE

N88-10613# European Space Agency, Paris (France).
ESA WORKSHOP ON OPTICAL INTERFEROMETRY IN SPACE
N. Longdon, ed. and V. David, ed. Aug. 1987 244 p Workshop held in Granada, Spain, 16-18 Jun. 1987
(ESA-SP-273; ISSN-079-6566; ETN-87-90917) Copyright Avail: NTIS HC A11/MF A01

Astronomical interferometry at high angular resolution; image reconstruction; space missions; and ground based interferometry were discussed. For individual titles, see N88-10614 through N88-10644.

N88-10614# Royal Signals and Radar Establishment, Malvern (England).
A COMPARISON OF INTERFEROMETRY FROM SPACE AND GROUND
A. H. Greenaway *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 5-10 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

It is argued that interferometry in space is superior to that from the ground only at visible frequencies. In the visible regime interferometry in space shows a clear advantage over interferometry from the ground only when observations on objects fainter than mv 10 are considered. To reach objects fainter than mv 14 in reasonable observation times (less than 1hr) it is shown that either: an extremely stable interferometer is required (uncalibrated errors less than lambda/6 over several seconds) or, a bright off-axis reference, mv less than 14, should be used to monitor errors in the (almost) common optical path. It is argued that mechanical tolerances on maintained geometry are fairly relaxed provided that they can be monitored to a very high precision. ESA

N88-10615# Observatoire de Paris-Meudon (France).
ABOUT THE INTEREST OF SOLAR INTERFEROMETRIC OBSERVATIONS
J. Heyvaerts *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 11-13 (For primary document see N88-10613 01-74)
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It is shown that the understanding of basic solar physical processes calls for high spatial resolution observation on the visible and in EUV lines. These processes are of general astrophysical interest. The scientific return expected from UV line observations of coronal loops with an angular resolution of 0.01 arcsec across the loop is described. ESA

N88-10616# Max-Planck-Inst. fuer Radioastronomie, Bonn (West Germany).
EXTRAGALACTIC VLBI OBJECTS: CANDIDATES FOR OPTICAL INTERFEROMETRY?
E. Preuss *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 15-19 (For primary document see N88-10613 01-74)
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Aspects of compact (less than or = 0.001 arcsec) optical and radio emission of active galactic nuclei and quasars relevant to interferometric observations in both spectral regimes are reviewed. A goal for joint observations is the investigation of broad line regions, their possible connection with nuclear radio sources, and the role of collimated outflow (jets) in these processes. Candidates for joint radio and optical observations, and pilot observations with optical interferometry are discussed. ESA

N88-10617# National Optical Astronomy Lab. Tucson, Ariz. Advanced Development Program.
IMAGING STRATEGIES FOR A SPACEBORNE INTERFEROMETER
Francois Roddier *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 23-29 Sponsored by NSF (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

Two strategies for spaceborne interferometry are suggested. The first is a large filled aperture consisting of a mosaic of light-weight mirrors. Internal referencing is used to coalign and approximately cophase the array. Diffraction-limited imaging is achieved by means of interferometric techniques such as roll deconvolution or pupil-plane interferometry. The second is a diluted array of diffraction-limited telescopes. Such an array can be exactly coaligned and cophased using internal and/or external reference. In case of either strategy, pointing accuracy and mechanical vibrations limit the system performances. ESA

N88-10618# National Radio Astronomy Observatory, Socorro, N. Mex.
IMAGING AT RADIO WAVELENGTHS **c89**
T. J. Cornwell *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 31-36 Sponsored by NSF (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

The layout of the telescope to form an array of interferometers; developments in correlator design; image processing algorithms; and computer hardware requirements are reviewed. Lines of development of radio interferometry are discussed. ESA

N88-10619# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Physik.
ISIS: IMAGE RECONSTRUCTION METHODS AND SIGNAL-TO-NOISE RATIO INVESTIGATIONS **c89**
K.-H. Hofmann and G. Weigelt *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 37-39 (For primary document see N88-10613 01-74)
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The signal-to-noise ratio of two image reconstruction methods, optical phase-closure imaging and speckle masking (triple correlation) are discussed. Results show that phase-closure imaging

yields images with higher signal-to-noise ratio than speckle masking for bright objects, and that speckle masking yields images with higher signal-to-noise ratio than phase-closure imaging for faint objects. ESA

N88-10620# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Physik.
ISIS: IMAGE RECONSTRUCTION EXPERIMENTS AND COMPARISON OF VARIOUS ARRAY CONFIGURATIONS c89
T. Reinheimer, K.-H. Hofmann, and G. Weigelt *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 41-43 (For primary document see N88-10613 01-74)
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The application of speckle masking (triple correlation processing) to coherent, telescope arrays in space is introduced. True diffraction-limited images are obtained since speckle masking is the solution of the phase problem in speckle interferometry. For example, a 14 m array can yield a resolution of 0.004 arcsec at 200 nm wavelength. Resolution of 0.000001 arcsec can be obtained with a 40 km array at 200nm. Computer simulations of optical aperture synthesis by speckle masking are shown. Simulations of a two-dimensional ring-shaped array and of a linear one-dimensional array are described. The dependence of the signal-to-noise ratio in the reconstructed image on photon noise is discussed. ESA

N88-10621# Observatoire de Toulouse (France).
ON THE CONCEPT OF RESOLUTION ELLIPSE IN APERTURE SYNTHESIS MATCHED DECONVOLUTION WITH ERROR ANALYSIS c89
A. Lannes and S. Roques *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 45-48 (For primary document see N88-10613 01-74)
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Optimization of the choice of synthetic aperture for astronomical interferometry is discussed. A procedure based on the notion of resolution to control the choice of parameters for a compromise between robustness and resolution is outlined. The regularization and deconvolution procedure is applied to the high-resolution study of the B component of the double QSO 2345 + 007. ESA

N88-10622# Netherlands Foundation for Radio Astronomy, Dwingelo.
OASIS: A MISSION CONCEPT c89
J. E. Noordam, A. H. Greenaway, J. D. Bregman, and R. S. lePoole (Leiden Univ., Netherlands) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 51-59 (For primary document see N88-10613 01-74)
(Grant NATO-723/84)
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A multiaperture optical interferometer, mounted on a single structure in space is proposed. The design is guided by radio aperture synthesis experience. The essential element is the use of a bright nearby reference object to equalize optical pathlengths in the array during long integrations on faint objects. The instrument has to be operated on an inherently unstable space platform, and the image processing must be done on the ground. Even such a limited instrument has a remarkable performance. An example for a 20m array with 9 telescopes is worked out. A 21st magnitude object is imaged with 5 milliarcsec resolution, spectral resolution of 0.25 nm, and a continuum dynamic range of 1:100. ESA

N88-10623*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
COSMIC
Wesley A. Traub *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 63-65 Sponsored by NASA and the Smithsonian Inst. Scholarly Studies Program (For primary document see N88-10613 01-74)
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The design goals of the COSMIC spaceborne telescope array concept are outlined. These include a high degree of structural stiffness, a wide field of view, and a broad wavelength band. These properties directly enhance the scientific productivity and technical reliability of the array. If a sufficiently stiff structure can be designed, COSMIC can operate as a phased array; if the structure relaxes before it can be rephased on a reference star, it degrades to a coherent array. The COSMIC engineering study suggests that passively-stabilized, phased arrays are feasible. ESA

N88-10624# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
BINARY STAR EXPLORER c89
Wesley A. Traub *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 67-68 Sponsored by the Smithsonian Inst. Scholarly Studies Program (For primary document see N88-10613 01-74)
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The Binary Star Explorer (BSE) a space interferometer for fundamental astrophysical measurements with a relatively simple instrument is proposed. The BSE will determine distances and masses of a large number of binary systems in our Galaxy and in the Magellanic Clouds. These binaries include many Cepheid systems, so that the fundamental distance scale can be calibrated accurately in terms of the directly measured quantities of angular separation and radial velocity. The proposed BSE takes full advantage of space, in that it uses the ultraviolet as well as the lack of atmospheric turbulence to make otherwise unobtainable measurements. ESA

N88-10625# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Physik.
ISIS: IMAGING SPECKLE INTERFEREOMETER IN SPACE
Gerd Weigelt *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 69-72 (For primary document see N88-10613 01-74)
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The construction of a large multimirror interferometer in space is proposed. Resolution of 0.001 arcsec at 100 nm is feasible with a 20 m baseline. A shuttle launched 14 m linear array, a 2 dimensional, deployable 20 m array, and arrays of 6 to 20 free-flying telescopes with baselines up to 40 km and resolution of 0.000001 arcsec at 200 nm are possible. At short UV wavelengths a multimirror interferometer will produce speckle interferograms caused by misalignment of the interferometer. From the speckle interferograms true images can be reconstructed by the phase-closure method (if the exit pupil is a nonredundant array) or by speckle masking (for general pupils). In the case of bright objects the phase-closure method yields higher signal-to-noise ratio than speckle masking. In the case of faint objects speckle masking yields higher signal-to-noise ratio than the phase-closure method. The limiting magnitude of optical long-baseline interferometry in space is 24 or fainter. ESA

N88-10626*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FIBER-LINKED TELESCOPE ARRAYS ON THE GROUND AND IN SPACE
P. Connes, F. Roddier, S. Shaklan (National Optical Astronomy Lab. Tucson, Ariz.), and E. Ribak *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 73-83 (For primary document see N88-10613 01-74)
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The use of single-mode optical fibers in telescope arrays, first proposed for a set of free-flying spacecraft, is developed and applied to more modest, shorter range projects. The basic advantage remains a considerable simplification in the control system; the main limitation is spectral range. Two proposals are described: a ground-based array of small optical telescopes supported on a radio dish, and a similar space array. The control system is almost the same in both cases, hence the ground-based array can be considered a test-bench for the space device. ESA

N88-10627*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
PROPOSED STUDIES OF A 30 METER IMAGING INTERFEROMETER CONCEPT
R. T. Stebbins, P. L. Bender, and J. E. Faller *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 85-91 (For primary document see N88-10613 01-74)
(Grant NAGw-822)
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An imaging interferometer in space based on the use of 15 m sections of graphite-epoxy truss structure to form the basic mechanical support system is suggested. One simple design is a Y-shaped array of 3 coplanar arms, each 15 m long and 1.5 m in diameter, together with a perpendicualr mast of similar length. Roughly 15 observing telescopes of 0.5 m diameter would be used, with laser interferometers controlling the optical pathlengths. The total mass of the imaging interferometer is 3000 kg. With this design, the entire interferometer can be carried to orbit with a single STS launch and then deployed. The interferometer could be operated either in a fully illuminated Sun-synchronous orbit at 1400 km altitude or loosely attached to the Space Station. ESA

N88-10628# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SPACE STATION BASED INTERFEROMETRY
H. Olthof *In its* ESA Workshop on Optical Interferometry in Space Aug. 1987 p 93-102 (For primary document see N88-10613 01-74)
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Applications of ESA programs to space interferometry are summarized. Inflatable, space rigidized technology; tethered spinning concepts; range measurement; laser Doppler radar; fine pointing elements for optical space communication; electric propulsion; and solid state accelerometers are discussed. ESA

N88-10629# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ESA TECHNOLOGICAL RESEARCH ACTIVITIES ON LIGHTWEIGHT MIRRORS
A. Connolly *In its* ESA Workshop on Optical Interferometry in Space Aug. 1987 p 103-110 (For primary document see N88-10613 01-74)
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Hardware research and development activities in ESA's Technological Research Program relating to lightweight mirrors are described. These include programs aimed at demonstrating the technology of imaging quality semipassive normal incidence mirrors of up to 4 m in diameter, and developing a replication technique for large scale production of grazing incidence mirrors. Manufacturing capabilities in passive lightweight mirrors are reviewed. ESA

N88-10630*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NASA/JPL STUDY ON OPTICAL IMAGING INTERFEROMETRY IN SPACE
S. P. Synnott, R. E. Freeland, E. Ribak, and E. F. Tubbs *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 113-115 (For primary document see N88-10613 01-74)
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The overall instrument morphology, optical design, structural configurations, and control and systems design for spaceborne optical interferometry are discussed. Launch stowage and on-orbit deployment considerations favor a Very Large Array Y-configuration, shuttle launched. ESA

N88-10631# Kitt Peak National Observatory, Tucson, Ariz.
GROUND-BASED OPTICAL INTERFEROMETRY
S. T. Ridgway *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 119-125 (For primary document see N88-10613 01-74)
(Contract NATO-CRG-86/0080)
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Progress in ground based multitelescope interferometry is reviewed. Interferometric methods progressed rapidly, leading to image reconstruction of numerous extended sources. Phase closure is demonstrated. Several two-telescope systems obtained fringes and results. Automation of a two-telescope interferometer is demonstrated. Scientific results include image reconstructions, accurate angular diameters, spatio-spectrally resolved emission lines from a Be star, asteroid shapes and maps, satellite diameters, measures of shells around young and old stars, and detections and measurement of binary and multiple stars. ESA

N88-10632# European Southern Observatory, Garching (West Germany).
GROUND-BASED INTERFEROMETRY WITH THE EUROPEAN VERY LARGE TELESCOPE (VLT)
Fritz Merkle *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 127-138 (For primary document see N88-10613 01-74)
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The linear array concept of the European Southern Observatory Very Large Telescope (VLT) is described. Four independent telescopes of the 8 m class are coupled together. This offers the possibility to operate the telescopes as a long baseline interferometer in the IR and visible wavelengths with a 104-m baseline. First target for the interferometric operation is the IR range and later a gradual expansion towards shorter wavelengths. Two smaller movable telescopes are added to the linear array for spatial frequency filling reasons. Adaptive optics will be applied for a real-time partial of full phase compensation of atmospheric distortions. Additional to phasing of the individual pupils of independently mounted telescopes, the whole array has to be phased, including pupil position corrections due to pupil foreshortening and shift effects. Technical requirements for phasing the synthetic aperture of the VLT interferometer are analogous to space based systems. ESA

N88-10633# Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, St. Vallier de Thiey (France).
CERGA HIGH ANGULAR RESOLUTION OPTICAL NETWORK
G. Schumacher, Ph. Bourlon, A. Boischot, P. Cruzalebes, M. Dugue, L. Koechlin, Y. Rabbia, and F. Vakili *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 139-143 (For primary document see N88-10613 01-74)
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A high angular resolution imaging interferometer prototype is described. It consists of a four phased telescope interferometer working at visible wavelengths. The goal is to demonstrate the feasibility of phase closure and image reconstruction. The apertures of the telescopes are limited to 26 cm, and move on 2 perpendicular baselines in a cross N/S and E/W configuration. The optical path compensation is done by delay lines, and the four beams are recombined on a fixed central table. The six fringe patterns are recorded by a short exposure, photon-counting camera in order to freeze the atmospheric turbulence. ESA

N88-10634# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PRACTICAL LIMITS TO GROUND BASED INTERFEROMETRY AND ITS IMPACT ON SPACE INTERFEROMETRY
M. Shao *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 145-149 (For primary document see N88-10613 01-74)
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A phase coherent stellar interferometer designed to make astrometric and stellar diameter measurements, in a fully automatic mode, is discussed. Experience shows that this instrument has the mechanical accuracy and thermal stability necessary for operation as an absolute interferometer, one whose mechanical and thermal imperfections are effectively nonexistent. A future absolute interferometer with 1 m elements can make photon starved measurements of fringe amplitude and closure phase on

objects as faint as 15 mag, competitive with many first generation space interferometers with 30 to 50 cm apertures. ESA

N88-10635# Consiglio Nazionale delle Ricerche, Milan (Italy). Ist. di Fisica Cosmica.
ON THE (LACK OF) PROPER MOTION OF THE VELA PULSAR **c89**
P. A. Caraveo, G. F. Bignami, and G. Vacanti *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 151-154 (For primary document see N88-10613 01-74)
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Optical data taken in Jan. 87 compared to the discovery plate of 1975.2 show no proper motion for PSR 0833-45, while a very significant one was expected if the pulsar originated in the center of the Vela supernova remnant (SNR), until now associated with it. If such an association is to be maintained, either an extreme asymmetry of the SNR is required, or both objects are much older than so far thought. Both alternatives appear not feasible, thus possibly casting doubts on the reality of this classic SNR/pulsar association. ESA

N88-10636# Barcelona Univ. (Spain).
RELATIVE MOTION NEAR THE TRIANGULAR LIBRATION POINTS IN THE EARTH-MOON SYSTEM **c13**
C. Simo, R. Martinez, G. Gomez, J. Llibre, W. Flury, and J. Rodriguez-Canabal (European Space Agency. European Space Operations Center, Darmstadt, West Germany) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 157-170 (For primary document see N88-10613 01-74)
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As the triangular libration points in the Earth-Moon system are of potential interest for optical interferometry, their dynamical property was analyzed adopting realistic models. Quasi-periodic orbits were identified, and their stability investigated. Results show that relative motion leads to baseline variation of 1 to 20 cm/sec, which may be unacceptably large for optical interferometry. ESA

N88-10637# Cambridge Univ. (England). Inst. of Astronomy.
MILLIARCSECOND GROUND-BASED IMAGING WITH SINGLE TELESCOPES
C. A. Haniff *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 171-173 (For primary document see N88-10613 01-74)
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Images reconstructed from data obtained with a four-element Michelson interferometer are presented. These demonstrate the importance of closure phase measurement at optical wavelengths and indicate that true diffraction-limited imaging with large ground-based telescopes is relatively straightforward. ESA

N88-10638# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
APERTURE SYNTHESIS IN SPACE: TECHNICAL PROBLEMS **c89**
D. Morancais and P. Roussel (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 177-185 (For primary document see N88-10613 01-74)
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The complexity and problems of space optical interferometers are examined. A schematic space interferometer is described based on its different tasks or modules. Requirements on these different modules are derived in order to achieve ideal performances. The starting point is an angular resolution of 0.0001 to 0.000001 arcsec, a magnitude above 10, and operating in the visible. These requirements give the order of magnitude of specifications for a Space Aperture Synthesis instrument. ESA

N88-10639# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
SOLAR INTERFEROMETRY WITH A 4-APERTURE NONREDUNDANT AND STABILIZED NETWORK
L. Dame, C. Aime, M. Faucherre, and J. Heyvaerts (Observatoire de Paris-Meudon, France) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 189-195 (For primary document see N88-10613 01-74)
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The solar fine structure investigation is discussed. Observations with a few hundredths arcsec resolution, i.e., 10 to 15 km on the Sun surface, are necessary. Inaccessible directly, such very high resolutions require interferometry. However, the design of a solar interferometer is intrinsically complex since many requirements, often found separately, and difficult by themselves, are brought together, i.e., UV spectral range, limb observations, resolved structures (low contrast) and time resolution. The stabilized interferometry technique, applied to a nonredundant array of four telescopes, provides an elegant solution to the problems. Implementation of the instrument on the space station should be possible in view of its compactness and internal metrology. ESA

N88-10640*# National Aeronautics and Space Administration, Washington, D.C.
A TEST-BED FOR SPACE INTERFEROMETRY: SPACE PLATFORM INTERFEROMETER (SPI)
M. Faucherre, L. Dame, R. V. Stachnik, and W. A. Traub (Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 197-204 (For primary document see N88-10613 01-74)
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The Space Platform Interferometer (SPI), a 20-m two-mirror Michelson interferometer, which can reach magnitude 14 at UV and visible wavelengths, is described. The SPI is attached to a platform serviced from the space station. In addition to its ability to produce unique science in the UV, SPI is intended to demonstrate the feasibility of larger projects in the field. Dynamical behavior of the structure in the gravity gradient environment and fringe stabilization at low photon rate are studied by picking up an adjacent bin (in the near IR) on the same object and using it to track the white light fringe in a separate differential interferometer. The same subsystem also corrects for tilt. Active control of critical parameters ensures optical rigidity. Performances are evaluated in low orbit. ESA

N88-10641# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
PERFORMANCES OF AN ACTIVELY STABILIZED STELLAR INTERFEROMETER (ASSI): FAINT MAGNITUDES, LOW FRINGE CONTRAST MEASUREMENTS AND OPERATIONALITY
L. Dame and M. Faucherre *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 205-215 (For primary document see N88-10613 01-74)
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Long baseline Michelson interferometry using a real time active stabilization of the central fringe position (fringe tracking) is described. The monitoring function (star pointing and optical path delay information) is clearly dissociated (and flux optimized) from the scientific analysis function, in which time integration and stability are favored for reasons of precision on the fringe contrast measurement. The driving concept of the instrumental design is the optimization of the received stellar flux for stabilization (on a white or achromatic unique fringe) and the use of narrow spectral bands for analysis. This stabilized spectrointerferometry method provides accurate measurements of low visibility (i.e., less than or = 1%) fringes together with access to faint magnitudes. Performances are found to be largely improved in comparison to classical stellar interferometry. ESA

N88-10642# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.

DIAGNOSTICS OF SOLAR CORONAL LOOPS AT INTERFEROMETRIC ANGULAR RESOLUTION **c92**

B. H. Foing, M. Faucherre, and L. Dame *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 217-219 (For primary document see N88-10613 01-74)

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The use of very high angular resolution imagery (equivalent to 20 km on the Sun) for extreme ultraviolet observations is discussed. It could be used to diagnose the fine structure in density and temperature of solar coronal loops. High angular resolution is of particular importance to estimate the filling factor of loops by hot and cool material, to measure radial gradients of temperature and density, and to observe flows, spatiotemporal evolution due to heating mechanisms, and interaction between loops. ESA

N88-10643# Universidad de la Laguna (Spain). Inst. de Astrofisica de Canarias.

IMAGE SHARPENING OBSERVATIONS OF ACTIVE GALACTIC NUCLEI **c90**

A. CamposAguilar, I. Perez-Fournon, and J. M. Carranza (Royal Greenwich Observatory, Hailsham, England) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 221-225 (For primary document see N88-10613 01-74)

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It is shown that recentering, selecting, and adding up sharp short-exposure images obtained with a photon-counting detector working in time-resolved mode can yield a gain in angular resolution better than a factor of 2. A cross-correlation selection algorithm, appropriate for faint and extended objects, is developed and compared with other image sharpness criteria. The limiting magnitude of the technique is 15 under normal conditions (seeing = 1 arcsec). Selecting the moments of best seeing during the night improves this limit by two or three magnitudes. Thus, a large number of extragalactic objects can be easily imaged with a resolution of a few tenths of an arcsec. Results for a sample of bright active galaxies are presented. ESA

N88-10644# European Southern Observatory, Garching (West Germany).

GALACTIC NUCLEI AND QUASARS AT HIGH ANGULAR RESOLUTION **c90**

M. H. Ulrich *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 227-231 (For primary document see N88-10613 01-74)

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Astrophysics and cosmology progress expected from high angular resolution observations in the optical and ultraviolet ranges is discussed. Gravitational lenses, gas and star motions in active nuclei; physics of jets; determination of the mass of individual compact objects in the dark halos of galaxies, and estimation of the fraction of the mass of the Universe which is in baryonic form are mentioned. ESA

N88-10645# Technische Univ., Berlin (West Germany). Fachbereich Physik.

CALORIMETRIC ABSORPTION SPECTROSCOPY (CAS): A NEW METHOD FOR THE CHARACTERIZATION OF THE OPTICAL PROPERTIES OF SEMICONDUCTOR SYSTEMS Ph.D. Thesis [CALORIMETRISCHE ABSORPTIONSSPEKTROSKOPIE (CAS) - EINE NEUE METHODE ZUR CHARAKTERISIERUNG DER OPTISCHEN EIGENSCHAFTEN VON HALBLEITERSYSTEMEN]

Andreas Juhl 1987 126 p In GERMAN

(ETN-87-90407) Avail: NTIS HC A07/MF A01

An apparatus for calorimetric absorption spectroscopy (CAS) and calorimetric transmission spectroscopy (CTS) at temperatures up to 1.3K, including computer control, data acquisition, and data evaluation, was built. At 1.3K, products of absorption coefficient and sample thickness up to 0.00001 can be determined with conventional light sources, with a time constant of 1 sec. It is shown that CAS is an efficient technique for the characterization of semiconductors and for the investigation of basic physical phenomena. Parameters which are relevant for the production process, and quantum efficiencies (using CTS) can be determined. The CAS experiments can be used for the study of mainly radiationless recombining centra in solid state materials, revealing fine structures. ESA

N88-10646# Heidelberg Univ. (West Germany). Naturwissenschalfttich-Mathematischen Gesamfakultaet.

THREE DIMENSIONAL RECONSTRUCTION OF OPTICAL MICROSCOPE PICTURES USING THE THREE DIMENSIONAL MICROSCOPIC INVERSE POINT SPREAD FUNCTION Ph.D. Thesis [3-D REKONSTRUKTION LICHTMIKROSKOPISCHER BILDER MIT HILFE DER DREIDIMENSIONALER INVERSEN PUNKTBILDFUNKTION DES MIKROSKOPS]

Eberhard A. Beck 1986 111 p In GERMAN

(ETN-87-90420) Avail: NTIS HC A06/MF A01

The three-dimensional (3D) reconstruction of object structures, whose optical-microscope image is degraded by diffraction effects, using the microscope optical transfer function (OTF) for the case of incoherent illumunation is described. The results show that the 3D reconstruction method improves the structural resolution of the microscope by a factor 1.5 parallel to the optical axis, and by a factor 1.8 perpendicular to the optical axis. Inverse Fourier transformation of the OTF allows the closed representation of the incoherent inverse point spread function with which a direct development in space can be performed, presenting an improvement compared to the development in frequency space. Proposals for hardware developments with a view to on-line 3D reconstruction are given. ESA

N88-10647# Sandia National Labs., Albuquerque, N. Mex.

GENERATING SOFT X-RAY SPECTRA USING THE SPEED PENTAXIAL DIODE

C. R. McClenahan, M. A. Hedemann, W. Beezhold, N. E. Counts, T. P. Lynch, D. J. Erven, and J. P. Reilly Jul. 1987 50 p (Contract DE-AC04-76DP-00789)

(DE87-013591; SAND-86-0957) Avail: NTIS HC A03/MF A01

At 70 kV charge voltage and three anode-cathode (A-K) gaps, 2.0, 2.5, and 3.0 mm, SPEED and the pentaxial diode provide bremsstrahlung-x-ray exposures with peak electron voltages of 350 +/- 60, 490 +/- 50, and 590 +/- 50 kV. At these voltages, the pentax delivers peak dose rates of 0.16 +/- 0.06, 0.33 +/- 0.08, and 0.57 +/- 0.10 x 10 to the 12th rad(CaF2)/s, respectively. The 4.4 cm radius opening in a steel clamp ring defines the high-exposure area of 60 sq cm, 2.1 cm from the tantalum converter. The peak dose occurs at a radius of 1.9 cm, with the axial dose reaching about 80% of the peak. The dose falls to about 70% of peak at 3.8 cm radius. We used the normal pentaxial diode hardware and charged the SPEED Marx generator to 70 kV instead of the normal 90 or 95 kV. A 30 cm diameter and 30 cm deep re-entrant bellows on the vacuum chamber contains the exposure area and maintains a normal atmosphere around the test object. Thermoluminescent dosimeters (TLDs) measured the dose to CaF2, and silicon PIN diodes measured the radiation pulse width. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N88-10648# Nagoya Univ. (Japan). Inst. of Plasma Physics.

STEADY STATE THETA PINCH CONCEPT FOR SLOW FORMATION OF FRC

K. Hirano May 1987 34 p

(ISSN-0469-4732; IPPJ-827) Avail: NTIS HC A03/MF A01

A steady state high beta plasma flow through a channel along the magnetic field increasing downstream can be regarded as a steady state theta pinch, because if the plasma is seen riding on the flow, a very similar process should be observed taking place

in a theta pinch. Anticipating production of an FRC with using very high voltage techniques, such as the ones required in a conventional theta pinch, the analogy (steady state reversed field theta pinch) which is brought about by steady head-on collision of counter plasma streams along the channel as ejected from two identical co-axial plasma sources mounted at both ends of the apparatus, is studied. The ideal Poisson and shock adiabatic flow models are employed for the analysis of the steady colliding process. It is demonstrated that an FRC involving large numbers of particles is produced only by the weak shock mode which is achieved in case energetic plasma flow is decelerated almost to stagnation through Poisson adiabatic process before the streams are collided. Author

N88-10649# Nagoya Univ. (Japan). Inst. of Plasma Physics.
FAST WAVE INJECTION INTO HIGH TEMPERATURE TOKAMAK PLASMAS IN THE LOWER-HYBRID-DENSITY REGIME OF JIPP T-IIU
K. Toi, Y. Hamada, K. Ohkubo, D. Eckhartt, R. Akiyama, R. Ando, S. Hirokura, K. Ida, E. Kako, and K. Kawahata et al. May 1987 31 p
(ISSN-0469-4732; IPPJ-828) Avail: NTIS HC A03/MF A01

Hard X-ray emission and suprathermal electron cyclotron emission are enhanced for density up to bar n sub e is approximately 1.8 x 10 to the 13th/cu cm by launching fast waves of 800 MHz into high temperature tokamak plasmas in the regime of lower hybrid resonance density on the JIPP T-IIU. The observed radial profile of the hard X-ray emission indicates that the suprathermal electrons are localized near the plasma axis, which is confirmed by the data obtained from a soft X-ray detector array and a high resolution crystal spectrometer. In the typical case of bar n sub e is approximately 1.3 to 1.5 x 10 to the 13/cu cm with phase differences between adjacent antennas delta phi = + 60 deg, the RF power absorbed by the suprathermal electrons is about 15 percent of the net injected RF power. The absorption rate is consistent with that of Landau damping on suprathermal electrons which pre-exist in a target plasma. The increment of the suprathermal electron density corresponds to an RF drive current approximately 25 kA, if the effective energy of the electrons is assumed to be 50 KeV. The dependence of the increment of total radiation and the amplitude of a lower side band on the phase difference delta phi agree well with the linear theory on fast wave coupling and propagation. The experimental data are also compared with preliminary results of slow wave injection into a similar target plasma. Author

N88-10650# California Univ., Los Angeles. Center for Plasma Physics and Fusion Engineering.
SELF-CONSISTENT MODIFICATION OF A FAST TAIL DISTRIBUTION BY RESONANT FIELDS IN NONUNIFORM PLASMAS
G. J. Morales, Merit M. Shoucri, and J. E. Maggs Aug. 1987 48 p
(AD-A183790; PPG-1089) Avail: NTIS HC A03/MF A01
CSCL 04A

An analytic study is made of the second order modifications produced on the fast tail electron distribution function of a nonuniform plasma subjected to resonant excitation by wave sources. The source models considered can represent excitation by external electromagnetic waves propagating obliquely to the plasma density gradient, mode-conversion of electrostatic whistlers, beat of two transparent electromagnetic waves, and direct conversion from ripples in the density profile. The calculation treats the Landau damping provided by fast tail electrons self-consistently and is applicable to plasmas having a long density scale length L, i.e., (kDL) to the 1/3 power is much greater than 1, where kD is the Debye wave number of the warm background electrons. A threshold condition is found for the formation of a positive slope in the tail distribution by the various excitation mechanisms. GRA

N88-10651# Lawrence Livermore National Lab., Calif.
MILLIMETER WAVE TOKAMAK HEATING AND CURRENT DRIVE WITH A HIGH POWER FREE ELECTRON LASER
K. I. Thomassen 1987 19 p Presented at the 14th Annual Conference on Plasma Physics, St. Andrew, England, 1 Jul. 1987
(Contract W-7405-eng-48)
(DE87-011324; UCRL-96774; CONF-870765-1) Avail: NTIS HC A03/MF A01

Experiments on microwave generation using a free electron laser (FEL) have shown this to be an efficient way to generate millimeter wave power in short, intense pulses. Short pulse FEL's have several advantages that make them attractive for application to ECR heating of tokamak fusion reactors. This paper reports on plans made to demonstrate the technology at the Microwave Tokamak Experiment (MTX) Facility. DOE

N88-10652# Wisconsin Univ., Madison.
TRANSVERSE FOCUSSING USING PLASMA WAKE FIELDS
D. B. Cline, B. Cole, J. Rosenzweig, and J. Norem 1987 4 p Presented at the Particle Accelerator Conference, Washington, D.C., 16 Mar. 1987 Prepared in cooperation with California Univ., Los Angeles and Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE87-011503; ANL-HEP-CP-87-24; CONF-870302-213) Avail: NTIS HC A02

Dense particle beams traveling in plasmas can produce very high electric and magnetic fields, and these fields can be used to accelerate and focus particles. The effects on trailing beams and self focusing can be strong and nonlinear. This paper discusses two aspects of self pinching beams: (1) the production of beams which do not self pinch, and (2) a short focal length plasma lens which uses self pinching to reduce beam sizes at the interaction point of a linear collider. As an example, a final focus system for the Stanford Linear Collider is considered. It is shown how the luminosity could be increased using this system. DOE

N88-10653# Los Alamos National Lab., N. Mex.
DIAGNOSTIC TECHNIQUE FOR MONITORING HIGH TEMPERATURE PLASMA DYNAMICS
A. H. Lumpkin and D. S. Pappas Jun. 1987 17 p Presented at the 19th Fluid Dynamics, Plasma Dynamics and Laser Conference, Honolulu, Hawaii, 8 Jun. 1987
(Contract W-7405-eng-36)
(DE87-011786; LA-UR-87-1929; CONF-870622-7) Avail: NTIS HC A03/MF A01

A preliminary design for the adaptation of a pinhole experiment (PINEX) technique to the monitoring of the dynamics of high temperature plasmas is described. Specifically, this imaging technique uses a thick aperture, an efficient radiation converter, and highly intensified television cameras to provide real-time viewing of radiation sources such as the neutron emissions from d-d and d-t fusion reactions in controlled thermonuclear research devices. The neutron emission strengths, R approx. 5 x 10 to the 15th power n/s, recently achieved at the Tokamak Fusion Test Reactor (TFTR) and the Joint European Torus (JET) should be sufficient for 3 to 6-cm spatial resolution and 10 to 100-ms time resolution using such a system. Such information should be useful for on-line optimization of the plasma and for quantitative evaluation of its performance. DOE

N88-10654# California Univ., Berkeley. Lawrence Berkeley Lab.
STATUS OF INERTIAL FUSION
D. Keefe Apr. 1987 8 p Presented at the Annual Meeting of Fusion Power Associates, Pleasanton, Calif., 8 Apr. 1987
(Contract DE-AC03-76SF-00098)
(DE87-010988; LBL-23326; CONF-870457-3) Avail: NTIS HC A02/MF A01

The technology advancement to high-power beams has also given birth to new technologies. That class of Free Electron Lasers that employs RF linacs, synchrotrons, and storage rings - although the use of the tools of High Energy Physics (HEP) - was developed well behind the kinetic energy frontier. The induction linac, however,

is something of an exception; it was born directly from the needs of the magnetic fusion program, and was not motivated by a high-energy physics application. The heavy-ion approach to inertial fusion starts with picking from the rich menu of accelerator technologies those that have, ab initio, the essential ingredients needed for a power plant driver: multigap acceleration - which leads to reliability/lifetime; electrical efficiency; repetition rate; and beams that can be reliably focused over a suitably long distance. The report describes the programs underway in Heavy Ion Fusion Accelerator Research as well as listing expected advances in driver, target, and beam quality areas in the inertial fusion power program. DOE

N88-10655# Texas Univ., Austin. Inst. for Fusion Studies.
NONLINEAR FLUID EQUATIONS FOR A LOW COLLISIONALITY TOROIDAL PLASMA
M. Kotschenreuther Jul. 1987 43 p
(Contract DE-FG05-80ET-53088)
(DE87-013006; DOE/ET-53088/284; IFSR-284) Avail: NTIS HC A03/MF A01

Nonlinear fluid equations are rigorously derived to describe resonant resistive perturbations localized near a rational surface in a torus, including neoclassical dissipative effects such as rotation damping and bootstrap current production which arise when the collisional mean free path exceeds the equilibrium scale length. A systematically ordered analysis with two parallel scales is used, for a low aspect ratio, starting directly from the drift-kinetic equation. The radial mode width is formally taken of order the poloidal gyroradius, and frequencies are taken to be sufficiently rapid that the perturbed poloidal and toroidal ion flows do not necessarily relax to satisfy the neoclassical equilibrium relation. This is realistic for many modes, and leads to some departures from standard neoclassical results. Neoclassical effects for electrons are relatively smaller than for ions so to include both consistently next order ion corrections are also included. For simplicity temperature perturbations are neglected. The new dissipative terms are shown to satisfy a field theoretic generalization of the Onsager symmetries, and the equations satisfy an H theorem. DOE

N88-10656# Los Alamos National Lab., N. Mex.
FUNDAMENTALS OF NUMERICAL MAGNETOHYDRODYNAMICS
J. U. Brackbill 1987 17 p Presented at the International School of Space Simulation, La Londe les Maures, France, 15 Jun. 1987
(Contract W-7405-eng-36)
(DE87-011769; LA-UR-87-2052; CONF-8706150-1) Avail: NTIS HC A03/MF A01

Magnetohydrodynamics is a fluid model for the motion of an ionized gas in a magnetic field. In its ideal, non-dissipative form, the Lundquist equations, it has the same mathematical character as the model for gas dynamics. It gives, in the same way, a self-consistent description of the fluid dynamics, including the exchange of momentum and energy between the field and the fluid. However, because of the greater complexity of the physics which they describe, some aspects of the solutions are quite different. The magnetic field introduces a strong anisotropic character to the medium which causes wave propagation to depend on the direction of propagation with respect to the magnetic field. In addition, there are several distinct speeds so that, in general, the responses to disturbances are quite complex. To capture the principal features of the solutions in numerical calculations, several problems must be addressed, some of which are unique to MHD: for example, preserving the solenoidality of the magnetic field. Others are similar to ordinary gas dynamics, such as energy conservation, numerical stability, and computational diffusion, but are more complex or have different consequences for MHD than for ordinary fluid flow. These fundamental problems in the numerical solution of the MHD equations are discussed as four topics: the dispersion of the Lundquist equations and the dispersion and stability of finite difference approximations; the conservation laws of MHD and the achievement of conservation in the numerical solutions; a discussion of convective transport and its role in computational diffusion; and finally, a method for preserving the solenoidality of the magnetic field. DOE

N88-10657# California Univ., Berkeley. Electronics Research Lab.
VORTEX DYNAMICS AND TRANSPORT TO THE WALL IN A CROSSED-FIELD PLASMA SHEATH
K. Theilhaber and C. K. Birdsall 10 Apr. 1987 15 p
(Contract DE-FG03-86ER-53220)
(DE87-013286; UCB/ERL-M-87/18) Avail: NTIS HC A03/MF A01

Results of numerical simulations of the time-dependent behavior of a transversely magnetized plasma-wall sheath are presented. These simulations were conducted to model plasma behavior in the vicinity of the limiters and walls of a fusion device. The two-dimensional, bounded particle simulation code ES2 is used as to investigate these edge effects, in an idealized geometry which retains, however, the essential features of the physics of the edge plasma. The simulations reveal that the bounded plasma is subject to the so-called Kelvin-Helmholtz instability, an instability maintained by the non-uniform electric field which is induced by the presence of the material walls. This instability is seen to saturate into large and stable vortices, with e phi/T(sub i) approx 1, which exist in the vicinity of the walls, and drift parallel to their surfaces. An important feature of these structures is that they continuously convect particles to the walls, at an anomalous rate much greater than that induced by collisional diffusion, a feature which seems tied to the mutual interaction of the vortices. In the ES2 code, volume ionization of neutrals has been modelled by a uniform electron-ion pair creation in the simulation region, and this results in a steady state, in which the linear edge instability, the nonlinear fluid dynamics of the vortices, and the nonlinear dynamics of the particles scattered by the vortices all balance each other. This steady-state but non-equilibrium configuration, which is a first model of the edge behavior induced by the boundaries, is conceptually analogous to Rayleigh-Benard convection. DOE

N88-10658# Lawrence Livermore National Lab., Calif.
LASER-PLASMA-INTERACTION EXPERIMENTS USING MULTIKILOJOULE LASERS
R. P. Drake Jul. 1987 27 p Presented at the 18th European Conference on Laser Interaction with Matter, Prague, Czechoslovakia, 4 May 1987
(Contract W-7405-eng-48)
(DE87-013483; UCRL-95981; CONF-8705172-1) Avail: NTIS

This paper summarizes the results of several laser-plasma-interaction experiments using multikilojoule lasers, and considers their implications for laser fusion. The experiments used 1.06, 0.53, 0.35, and 0.26 microns light to produce relatively large, warm, planar plasmas and to study the effect of laser wavelength and density-gradient scale length on the Stimulated Raman Scattering and on the scattering of light at frequencies near the incident laser frequency by Stimulated Brillouin Scattering or other processes. The results of these experiments suggest that some laser wavelength between 0.2 and 0.6 microns will be required for high-gain laser fusion. DOE

N88-10659# Kiruna Geophysical Inst. (Sweden).
LOCAL SPECTRA AND WAVE DISTRIBUTION FUNCTIONS
Kjell Roennmark and Jonas Larsson Jun. 1987 19 p Submitted for publication
(KGI-Preprint-099; ISSN-0349-2656; ETN-87-90740) Avail: NTIS HC A03/MF A01

The discrepancy between wave spectra observed by satellites in space which are local, in the sense that they depend on the time and place of observation, and Fourier transforms and power spectra which are global quantities, defined by integrals over infinite intervals are discussed. Difficulties can be overcome if a definition of a local power spectrum is adopted. The proposed definition is closely related to experimental practice, yet very convenient in analytical calculations. A distribution function, and an associated

continuity equation for the wave energy density in a plasma is derived. ESA

N88-10660# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
MODE PURITY MEASUREMENTS ON GYROTRONS FOR PLASMA HEATING AT THE STELLARATOR W 7-AS
H. J. Barkley, V. Erckmann, W. Kasparek, H. Kumric, G. A. Mueller, P. G. Schueller, M. Thumm, and R. Wilhelm Mar. 1987 19 p Submitted for publication
(IPF-87-3; ETN-87-91018) Avail: NTIS HC A03/MF A01

For electron cyclotron resonance heating of plasmas in the stellarator, high-power microwave sources with high mode purity were studied. The mode compositions of 4 commercial 200 kW/70 GHz gyrotrons were analyzed with a wavenumber spectrometer. The measurements confirm the specified spurious mode content of less than 10%. ESA

N88-10661# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY PLASMA FUSION CENTER: 1986-1987 REPORT TO THE PRESIDENT
Jul. 1987 21 p
(Contract DE-AC02-78ET-51013)
(DE87-013518; PFC/IR-87-1) Avail: NTIS HC A03/MF A01

During the past year, technical progress has been made in all Plasma Fusion Center (PFC) research programs. The Plasma Fusion Center is recognized as one of the leading university research laboratories in the physics and engineering aspects of magnetic confinement fusion. Its research programs have produced significant results on four fronts: (1) the basic physics of high-temperature plasmas (plasma theory, RF heating, free electron lasers, development of advanced diagnostics and small-scall experiments on the Versator tokamak and Constance mirror devices), (2) major confinement results on the Alcator C tokamak, including pioneering investigations of the stability, heating, and confinement properties of plasmas at high densities, temperatures and magnetic fields, (3) operation of the medium-scale TARA tandem mirror, an axisymmetric confinement configuration with inboard thermal barriers, and (4) a broad program of fusion technology and engineering development that addresses problems in several critical subsystem areas (e.g., magnet systems, superconducting materials development, environmental and safety studies, advanced millimeter wave source development, and system studies of fusion reactor design, operation, and technology requirements). DOE

N88-10662# Ames Lab., Iowa.
DIRECT DETECTION OF OPTICAL RADIATION THROUGH A SAMPLING ORIFICE FOR INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROSCOPY Ph.D. Thesis
B. R. LaFreniere Aug. 1987 212 p
(Contract W-7405-eng-82)
(DE87-013609; IS-T-1310) Avail: NTIS HC A10/MF A01

The direct optical viewing of an argon inductively coupled plasma (ICP) through a sampling orifice inserted directly into the plasma has been accomplished. A copper cone with a sampling orifice is attached to the entrance slit chamber of a monochromator and inserted directly into an ICP to obtain optical spectra in the vacuum ultraviolet (VUV). With solar-blind photomultiplier tube (PMT) detection, detection limits are 50 ng mL-1 for the resonance lines of Br and Cl during injection into the plasma of aerosols of aqueous solutions generated by pneumatic nebulization. With ultrasonic nebulization, the detection limits improve to 8 ng mL-1 for Br and 15 ng mL-1 for Cl. Detection limits for Br and Cl in the form of an aqueous sample were superior to the best reported values in the Ar and He ICP, and in the microwave-induced plasma atomic emission spectroscopy (MIP-AES) literature. Another significant breakthrough in the present work includes the determination of nonmetals in gases by their direct injection into the ICP by a device called a direct injection probe (DIP). This low dead volume interface (less than 40 microL) is used for the introduction of gaseous samples directly into the axial channel of the ICP. Injection of a gaseous mixture of compounds containing the elements Br, Cl, S, and C results in detection limits of 0.1, 0.3, 0.05, and 1 ng, respectively. These detection limits are by far the best obtained for these elements in a gaseous form by ICP-AES. The extension of ICP-AES analysis to the determination of nonmetals, metalloids, and/or selected metals in aqueous and gaseous samples illustrates the value of this optical sampling approach in the VUV. DOE

N88-10663# New York Univ., New York. Inst. of Mathematical Sciences.
PLASMA PROPERTIES Annual Report
1987 34 p
(Contract DE-FG02-86ER-53223)
(DE87-013662; DOE/ER-53223/T1) Avail: NTIS HC A03/MF A01

The Magneto-Fluid Dynamics Division of the Courant Institute is engaged in a broad program of basic research in the theoretical aspects of plasma physics and magneto-fluid dynamics with emphasis on those areas which are relevant to the fusion energy program. The research program includes plasma containment, stability, equilibrium, transport, wave propagation (including shock waves), heating, orbit theory, as well as numerical experiments and the development of practical numerical methods in all plasma problems. Applications are made to the following project areas: Tokamaks, Mirrors, Stellarators, and Alternate Concepts. Developments include the whole spectrum of models from macroscopic MHD and guiding center to Vlasov, drift kinetic Fokker-Planck, and Boltzmann. This document describes research completed as well as programs in progress. DOE

N88-10664# Wisconsin Univ., Madison. Fusion Technology Inst.
FUSION REACTOR PHYSICS AND TECHNOLOGY STUDIES Final Report, 1 Dec. 1985 - 15 Jun. 1986
G. L. Kulcinski, G. A. Emmert, J. F. Santarius, and I. N. Sviatoslavsky Sep. 1986 79 p
(Contract DE-FG02-86ER-52128)
(DE87-013691; DOE/ER-52128/1) Avail: NTIS HC A05/MF A01

The work performed for Fusion Reactor Physics and Technology Studies was to participate with Lawrence Livermore National Laboratory (LLNL) and others in the design of the Minimars Tandem Mirror power reactor. This design activity was a collaborative effort with LLNL being responsible for the physics and program administration. The Fusion Technology Institute (FTI) of the University of Wisconsin was responsible for nuclear technology (central cell blanket/reflector/shield design, neutronics, activation, tritium issues, and end cell shielding), and the design of the central cell magnets. In addition, FTI provided assistance to LLNL on the plasma physics modeling of the plasma halo. An interim report on the Minimars design has been issued, and a final report covering all aspects of Minimars is in press. In addition, various reports and conference papers covering aspects of the design have been issued, and are listed in this report. A summary of the FTI contribution to the Minimars design study is presented. DOE

N88-10743*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Space Science Dept.
OVERVIEW OF PLASMA OBSERVATIONS DURING THE HALLEY FLYBYS Abstract Only
R. Reinhard *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 39 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLASMA-TAIL ACTIVITY AND THE INTERPLANETARY MEDIUM AT HALLEY'S COMET DURING ARMADA WEEK: 6-14 MARCH 1986 Abstract Only

Malcolm B. Niedner, Jr., Konrad Schwingenschuh, J. Todd Hoeksema, Murray Dryer, and Patrick S. McIntosh (National Oceanic and Atmospheric Administration, Boulder, Colo.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 51 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10755*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
A SIMULATION OF THE IPS VARIATIONS FROM A MAGNETOHYDRODYNAMICAL SIMULATION Abstract Only
S. J. Tappin, M. Dryer, S. M. Han, and S. T. Wu (Alabama Univ., Huntsville.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 54 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N88-10665 British Petroleum Co. Ltd., London (England).
PREPARATION OF POLYMER POLYOLS Patent Application
Rudolphe Charley Cloetens, inventor, Werner August Lidy, inventor, and Huy PhanThanh, inventor 27 Nov. 1985 21 p Filed 24 Apr. 1985 Priority 24 Apr. 1984 GB 8410480
(EP-Patent-0-162-589-A1; EP-Patent-Appl-SN-85302847.0; Int-Patent-Class-C08L-71/02; Int-Patent-Class-C08G-18/38; Int-Patent-Class-C08G-18/50; Int-Patent-Class-C08G-18/63; ETN-87-98638) Avail: UK Patent Office, 25 Southampton Buildings, London WC2A 1A4, United Kingdom

A family of modified polyols for use in the preparation of fluid polymer/polyols is provided. The modified polyols are obtained by reacting a silicon atom containing compound with an unmodified polyol. The silicon atom compound has at least olefinically unsaturated hydrocarbyl group and at least one functional group which is reactable with the hydroxy groups on the polyol. Examples of such silicon atom containing compounds include vinyltriethoxysilane and vinyltrimethoxysilane. Modified polyols of the type described are particularly useful in the preparation of polymer/polyols containing high levels of polymer since they reduce the viscosity of the final polymer polyol, and decrease the tendency of the polymer/polyol to produce polymer sediment. ESA

N88-10666*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACCURATE AB INITIO CALCULATIONS WHICH DEMONSTRATE A 3 Pi u GROUND STATE FOR Al2
Charles W. Bauschlicher, Jr., Harry Partridge, Stephen R. Langhoff, Peter R. Taylor, and Stephen P. Walch (Eloret Corp., Sunnyvale, Calif.) [1986] 22 p
(Contract NCC2-296)
(NASA-TM-89302; NAS 1.15:89302) Avail: NTIS HC A03/MF A01 CSCL 20L

The spectroscopic parameters and separations between the three low-lying X 3 Pi u, A 3 Sigma g -, and a 1 Sigma g + states of Al2 are studied as a function of both the one-particle and n-particle basis set. Approximate correlation treatments are calibrated against full CI calculations correlating the six valence electrons in a double-zeta plus two d-function basis set. Since the CASSCF/MRCI 3 Pi u to 3 Sigma g - separation is in excellent agreement wtih the FCI value, the MRCI calculations were carried out in an extended (20s13p6d4f)/(6s5p3d2f) gaussian basis. Including a small correction for relativistic effects, the best estimate is that 3 Sigma g - state lies 174/cm above the 3 Pi u ground state. The 1 Sigma g + state lies at least 2000/cm higher in energy. At the CPF level, inclusion of 2s and 2p correlation has little effect on D sub e, reduces T sub e by only 26/cm, and shortens the bond lengths by about 0.02 a sub o. Further strong support for a 3 Pi u ground state comes from the experimental absorption spectra, since both observed transitions can be convincingly assigned as 3 Pi u yields 3 Pi g. The (2) 3 Pi g state is observed to be sensitive to the level of correlation treatment, and to have its minimum shifted to shorter rho values, such that the strongest experimental absorption peak probably corresponds to the 0 yields 2 transition. Author

N88-10667# Los Alamos National Lab., N. Mex.
A SIMULATION STUDY OF INTERFACES IN Ni, Al AND Ni3Al WITH AND WITHOUT BORON
S. P. Chen, A. F. Voter, and D. J. Srolovitz 1987 8 p Presented at the Conference on Interface Science and Engineering, Lake Placid, N.Y., 12 Jul. 1987
(Contract W-7405-eng-36)
(DE87-013156; LA-UR-87-2366; CONF-870793-1) Avail: NTIS HC A02/MF A01

Atomistic simulations of free surfaces and (001) symmetric tilt grain boundaries in pure Ni and Al and the intermetallic, Ni3Al, are presented. In the vicinity of the grain boundary, we show the existence of a rapidly decaying oscillatory strain which is similar to that observed at free surfaces. The total expansion or excess volume associated with the grain boundary is shown to be proportional to the grain boundary energy. The atomistic structures of the simulated grain boundaries have been analyzed in terms of the structural unit model, which is found to be of limited utility in the case of the intermetallic. Preliminary results show that boron segregates more strongly to grain boundaries than to free surfaces. Boron segregation strengthens the grain boundary but has little effect on grain boundary structure other than a small local expansion. DOE

N88-10668# International Centre for Theoretical Physics, Trieste (Italy).
SOME ELECTRONIC FACTORS INFLUENCING SUPERCONDUCTIVITY IN SOME RARE-EARTH-LIKE ELEMENTS AND THE BEGINNING OF RARE-EARTH SERIES
Liyuan Zhang Oct. 1986 6 p
(DE87-702582; IC-86/270) Avail: NTIS (US Sales Only) HC A02/MF A01

In this paper the author points out some general trends in some electronic factors of rare-Earth-like and rare-Earth series, which are related to superconductivity. DOE

N88-10669# International Centre for Theoretical Physics, Trieste (Italy).
ELECTRONIC STRUCTURE OF CRYSTALLINE NaSn
M. El-Hasan and M. Tomak Oct. 1986 6 p
(DE87-702583; IC-86/273) Avail: NTIS (US Sales Only) HC A02/MF A01

The electronic structure calculation of solid NaSn using the recursion method is reported. The crystalline structure is assumed to be CsCl. The Fermi level is found to intersect the broad Sn p-band complex. DOE

N88-10670# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ELECTRICAL BEHAVIOR OF LAYERS IMPLANTED WITH LOW ENERGY PIONS IN Si [COMPORTAMENTO ELETRICO DE CAMADAS IMPLANTADAS POR IONS DE P DE BAIXA ENERGIA NO Si]
E. Granato, R. Ranvaud, A. FerreiradaSilva, I. C. daCunhaLima, and J. P. deSouza Jun. 1987 23 p In PORTUGESE Submitted for publication
(INPE-4199-PRE/1051) Avail: NTIS HC A03/MF A01

The electrical behavior of P implanted layers in p-Si, obtained through ionic implantation layers, was investigated with 12 KeV of energy for 6 different doses, which varied from 10 to the 12th to 10 to the 16th/sq cm. The electrical properties are examined through resistivity measurements of the sheets by temperature functions 300 to 4.2 K. The distribution determination of carrier density and mobility depth was obtained through half measurements

of Hall and resistivity coefficients of the sheets, since displacement of successive finished layer shows implantation through anodic oxidation of the Si. The measured results are interpreted using a simplified model which takes into account the distribution in the depth of the impurities and compensation. The analysis of the conductivity behavior with the temperature indicates the existence of two regimes of conductivity. The highest temperature region, the activation energy can be interpreted in terms of experimental and theoretical results which are joined in the literature of Si doped with P. For most decreasing temperatures, the activation energy obtained, indicates the presence of compensating defects.

Author

N88-10671# Los Alamos National Lab., N. Mex.
GAINING CONTROL OVER RARE EARTH VALENCE FLUCTUATIONS
D. Wohlleben 31 May 1987 6 p Presented at the NATO Advanced Workshop on Narrow Band Phenomena, Staverden, Netherlands, 31 May 1987
(Contract W-7405-eng-36)
(DE87-010116; LA-UR-87-1611; CONF-8705120-2) Avail: NTIS HC A02/MF A01

This paper briefly deals with the problem of narrow band materials. It addresses a new theoretical approach to the fluctuation of valence electrons in rare earth elements. It is believed that the phenomena of interest arise from an instability of the partially filled d or f shell of certain atoms when they are put into a metallic host. The theoretical models which dominate the scene work with two local d or f states on one hand and a structureless sea of free conduction electrons on the other. This procedure ignores at least half of the essential physics; the other held is kept alive in the term valence fluctuation. Basically, what the prevalent models ignore is that, in all these systems, the entire atoms as the source of the anomalies are being dealt with, not just their f shells. In other words, there is important structure in the sea of conduction electrons.

DOE

N88-10672# Fermi National Accelerator Lab., Batavia, Ill.
SIMPLE INSTRUMENTATION FOR TESTING OF CERAMIC SUPERCONDUCTORS
M. Kuchnir and F. Markley 17 Jun. 1987 6 p Presented at the Conference on Advances in Cryogenic Engineering, St. Charles, Ill., 14 Jun. 1987
(DE87-013849; FNAL-TM-1464; CONF-8706125-11) Avail: NTIS HC A02/MF A01

In order to compare procedures for fabricating YBa Cu O sub 7-x samples in a fast and convenient way we have used two inexpensive devices: a rather sensitive pendulum for indication of the amount of superconducting phase in the sample and a transformer for the measurement of critical current. Both devices are described in detail.

DOE

N88-10673# Sandia National Labs., Albuquerque, N. Mex.
GRAIN BOUNDARY EFFECTS IN PROCESSING HIGH T/SUB c/ SUPERCONDUCTORS
D. S. Ginley, E. L. Venturini, J. F. Kwak, R. J. Baughman, and B. Morosin 1987 6 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE87-009297; SAND-87-1156C; CONF-871027-12) Avail: NTIS HC A02

The advent of superconductors with transitions above 77K has tremendous practical implications. We demonstrate that even in single phase YBa Cu Oa, intergrain effects at high temperature (700 to 1100°C) dominate the synthesis of the material. In fact, superconductivity occurs in thin shells (less than 0.4 microns) surrounding non-superconducting grains in all of the recent high T sub c materials independent of stoichiometry and synthesis method. We believe the nature of the superconducting shells to be unique and present data demonstrating their existence and the mechanism of their formation.

DOE

N88-10674# Pennsylvania State Univ., University Park.
METAL-SENSING LAYER-SEMICONDUCTOR AND METAL-SENSING LAYER-METAL HETEROSTRUCTURE GAS SENSORS
M. OLeary, Zheng Li, and S. J. Fonash 1987 7 p Presented at the 172nd Meeting of the Electrochemical Society, Honolulu, Hawaii, 18 Oct. 1987
(Contract DE-AC02-76CH-00016)
(DE87-011293; BNL-39910; CONF-871027-29) Avail: NTIS HC A02/MF A01

Extremely sensitive gas sensors can be fabricated using heterostructures of the form metal-sensing layer-semiconductor or metal-sensing layer-metal. These structures are heterostructure diodes which have the barrier controlling transport at least partially located in the sensing layer. In the presence of the gas species to be detected, the electrical properties of the sensing layer evolve, resulting in a modification of the barrier to electric current transport and, hence, resulting in detection due to changes in the current-voltage characteristics of the device. This type of sensor structure is demonstrated using the Pd/Ti-O(sub x)Ti heterostructure hydrogen detector.

DOE

N88-10675# Oak Ridge National Lab., Tenn.
DIRECT FORMATION OF THIN FILMS AND EPITAXIAL OVERLAYERS AT LOW TEMPERATURES USING A LOW-ENERGY (10-500 eV) ION BEAM DEPOSITION SYSTEM
R. A. Zuhr, G. D. Alton, B. R. Appleton, N. Herbots, T. S. Noggle, and S. J. Pennycook 1987 9 p Presented at the European Materials Research Society Conference, Strasbourg, France, 2 Jun. 1987
(Contract DE-AC05-84OR-21400)
(DE87-012291; CONF-8706152-3) Avail: NTIS HC A02/MF A01

A low-energy ion beam deposition system has been developed at Oak Ridge National Laboratory and has been applied successfully to the growth of epitaxial films at low temperatures for a number of different elements. The deposition system utilizes the ion source and optics of a commercial ion implantation accelerator. The 35 keV mass- and energy-analyzed ion beam from the accelerator is decelerated in a four-element electrostatic lens assembly to energies between 10 and 500 eV for direct deposition onto a target under UHV conditions. Current densities on the order of 10 microA/sq cm are achieved with good uniformity over a 1.4 cm diameter spot. The completed films are characterized by Rutherford backscattering, ion channeling, cross-section transmission electron microscopy, and x-ray diffraction. The effects of substrate temperature, ion energy, and substrate cleaning have been studied. Epitaxial overlayers which show good minimum yields by ion channeling (3 to 4%) have been produced at temperatures as low as 375 C for Si on Si(100) and 250 C for Ge on Ge(100) at growth rates that exceed the solid-phase epitaxy rates at these temperatures by more than an order of magnitude. the solid-phase epitaxy rates at these temperatures by more than an order of magnitude.

DOE

N88-10676# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
DYNAMICAL SIMULATION OF STRUCTURAL MULTIPLICITY IN GRAIN BOUNDARIES
I. Majid and P. D. Bristowe Jun. 1987 7 p
(Contracts DE-FG02-87ER-45310; DE-FG02-84ER-45116)
(DE87-012746; DOE/ER-45310/2) Avail: NTIS HC A02/MF A01

Work on a computer simulation study of a low-energy high-angle boundary structure which is not periodic have been recently reported. This result is of interest since grain boundary structures are usually assumed to have a periodicity corresponding to the appropriate coincidence site lattice (CSL) and many experimental observations of the structure of grain boundaries performed using conventional and high-resolution electron microscopy, electron diffraction and X-ray diffraction appear to support this work. However, this work, using empirical interatomic pair potentials and the relaxation method of molecular statics, have simulated a

Sigma=5 (36.87 deg)(001) twist boundary and found a low energy structure having a larger repeat cell than the CSL and is composed of two different types of structural unit randomly distributed in the boundary plane. This result, termed the multiplicity of grain boundary structures, has also been found in the simulation of tilt boundaries. The multiplicity phenomenon is of special interest in twist boundaries since it is used as a structural model to explain the X-ray scattering from a Sigma=5 boundary in gold. These scattering patterns had previously remained unexplained using stable structures that had simple CSL periodicity. Also, the effect of having a multiple number of low energy structural units coexisting in the grain boundary is of more general interest since it implies that the boundary structures may be quasi-periodic and, in some circumstances, may even result in a roughening of the boundary plane. This work is extended by showing, using molecular dynamics, that a multiplicity of structural units can actually nucleate spontaneously in a high-angle grain boundary at finite temperatures. DOE

N88-10677# Sandia National Labs., Albuquerque, N. Mex.
UNDERSTANDING THE TRANSPORT PROPERTIES OF SILICON GRAIN BOUNDARIES AND HOW THEY RELATE TO I.C. APPLICATIONS OF POLYSILICON
C. H. Seager 1986 26 p Presented at the Silicon Material Research Symposium, Hsin-Chu, Taiwan, 28 Nov. 1986
(Contract DE-AC04-76DP-00789)
(DE87-013809; SAND-87-1883C; CONF-8611185-1) Avail: NTIS HC A03/MF A01

Silicon integrated circuit technology utilizes polycrystalline silicon (polysilicon) for a variety of purposes ranging from gates and conductor lines to resistors and, recently, even active devices. The structural, chemical, and electrical properties of silicon grain boundaries play a fundamental role in determining the operational characteristics of these polysilicon elements. In many cases process control problems, such as the extreme sensitivity of poly resistivity to dopant level variations, can be traced directly back to the fundamental nature of the double depletion layers that surround most silicon grain boundaries. In the past 10 years studies of the fundamental transport properties of single grain boundaries have provided a clear theoretical picture for predicting the current flow across such structures. Information in this area is reviewed. Predicting the electrical properties of a real polycrystalline film remains a difficult task. Inhomogeneities in the structure of single boundaries, crystallographic dependence of potential barrier heights, grain boundary dopant segregation and diffusion, plus other effects are the source of the complex properties of a typical real-world polysilicon device. DOE

N88-10678# State Univ. of New York, Stony Brook. Dept. of Physics.
X-RAY STUDIES OF STRAIN, INTERFACE AND IMPURITY IN SEMICONDUCTORS Technical Progress Report, 1 Nov. 1986 - 31 Jul. 1987
Yi-Han Kao 1987 13 p
(Contract DE-FG02-87ER-45283)
(DE87-013856; DOE/ER-45283/T1) Avail: NTIS HC A03/MF A01

Residual strains were measured in As-implanted Si and SiO2/Si heterostructures. Interfacial roughness and surface roughness were measured in several heterostructures. High-temperature superconductors (Y-Ba-Cu-O) are being studied. Wavelength-modulated X-ray spectroscopy is being developed. DOE

N88-10679# Arizona Univ., Tucson.
GRAIN BOUNDARY PHASE EQUILIBRIA IN METALLIC SYSTEMS Progress Report, 1 Dec. 1986 - 30 Nov. 1987
P. Deymier, V. Campos, and H. Evans Aug. 1987 12 p
(Contract DE-FG02-87ER-45285)
(DE87-014123; DOE/ER-45285/1) Avail: NTIS HC A03/MF A01

One of the primary objectives of this joint experimental/computational research program on grain boundaries in metals is to reconcile experiments and calculations. Both areas have been so often conducted separately for facility's sake that loss of coherency is the recurrent characteristic of research on internal interfaces. Progress has been made consistent with the original objectives of the proposal both in the theoretical and experimental areas. On the theoretical side, analytical expressions to generate density dependent interatomic potentials in simple metals have been elaborated. Extension of the constant stress molecular dynamics technique to these volume dependent potentials is under way. The molecular dynamics code has been revised to improve its performances on vectorial processors. On the experimental side, an Electron Beam Float-Zone Refiner has been designed and built. The floating zone method has been selected for the preparation of highly pure Al bicrystals as well as bicrystals doped with Mg. The apparatus is currently under testing. Actual simulation of bulk and defected metallic systems and preparation of Al bicrystals of controlled misorientation is anticipated for the near future. DOE

N88-10680*# Virginia Univ., Charlottesville. Semiconductor Device Lab.
OPTIMIZATION OF SIS MIXER ELEMENTS Final Report
Robert J. Mattauch Dec. 1985 145 p
(Contract NAS5-26466)
(NASA-CR-180710; NAS 1.26:180710; UVA/528204/EE86/101)
Avail: NTIS HC A07/MF A01 CSCL 20L

Superconductor-Insulator-Superconductor (SIS) quantum mixers provide an approach to millimeter wave mixing - potentially offering conversion gain, a low local oscillator power demand, and potential mixer noise temperatures near the quantum limit. The development of a reliable fabrication technology for producing such high quality SIS devices for mixer applications in radio astronomy is the focus of the work. Author

N88-10681# Stockholm Univ. (Sweden). Inst. of Physics.
A DATA ANALYSIS PACKAGE FOR RDF-DETERMINATION FROMEXELFS-SPECTRA
H. Haakansson, Chr. Bohm, S. Cssillag, and Z. Xu May 1987 24 p
(USIP-87-07; ETN-87-90750) Avail: NTIS HC A03/MF A01

Data analysis programs used in the analysis of the fine structure on the high energy side of ionization edges are described. This fine structure (EXELFS EXtended Energy Loss Fine Structure) is due to the interference between the outgoing spherical electron waves and the surrounding atoms. ESA

N88-10682# Technische Univ., Berlin (West Germany). Fachbereich Physik.
ENERGY-SELECTED ELECTRON DIFFRACTION EXPERIMENTS USING THE ROCKING-CRYSTAL METHOD IN THE RASTER MICROSCOPE FOR THE INVESTIGATION OF LOCALIZATION EFFECTS IN SINGLE CRYSTALS Ph.D. Thesis [ENERGIESELEKTIERTE NTE MITTELS DER KRISTALLDIPP-METHODE IM RASTERMIKROSKOP ZUR UNTERSUCHUNG VON LOKALISATIONSEFFEKTEN AN EINKRISTALLEN]
Winfried Hylla 1986 122 p In GERMAN
(ETN-87-90409) Avail: NTIS HC A06/MF A01

The effect of the localization of Bloch waves, i.e., the nonhomogeneous electron current density distribution over the crystal unit cell, was investigated. The electron diffraction patterns were taken with the rocking-crystal method using a microprocessor-controlled raster electron microscope. A program for computer aided indexing and orientation determination is demonstrated. Energy-selected electron diffraction patterns were obtained using a magnetic sector-field spectrometer, integrated in the process controls and a two-energy detection system allowing background-corrected characteristic energy loss patterns. The localization effect of Bloch waves in graphite and silicon was investigated using characteristic energy loss diagrams. In graphite, the localization contrast was emphasized by a special detector position. The possibilities of impurity position determination in single crystals using the localization contrast are demonstrated. ESA

N88-10683# Ames Lab., Iowa.
ABRIKOSOV VORTEX MOTION AND ELEMENTARY PINNING FORCE IN A SNS JOSEPHSON JUNCTION Ph.D. Thesis
Ok-Bae Hyun Aug. 1987 177 p
(Contract W-7405-eng-82)
(DE87-013607; IS-T-1218) Avail: NTIS HC A09/MF A01

Procedures have been developed to determine the location of a single Abrikosov vortex in a Superconductor-Normal metal-Superconductor (SNS) Josephson junction and study its motion under the influence of a Lorentz force. A vortex in a SNS junction generates characteristic magnetic field inside the junction and this field, in turn, induces a specified phase across the junction. This phase caused by the vortex changes the critical current characteristics of the junction, that then can be used to locate the vortex inside the junction. A single vortex was successfully trapped in the junction by the field cooling process and the location was determined by the diffraction pattern. Motion of the vortex was induced by the transport current, I/sub p/, and the vortex was found to move in discrete jumps. By tracing the vortex after successive depinning events, many pinning centers could be identified. From the minimum depinning current, the elementary pinning force associated with an individual pinning site of the Pb-Bi (4 at. %) superconducting layer has been measured and found to be of order of 10 to the minus 8th dyne (or .0001 dyne/cm) at T/T/sub c/ = 0.95. The force is asymmetric and different from one pinning site to another. For the given SNS junction, the pinning force of a pinning center is dominant over all other forces associated with the vortex in the junction. In addition, from the experiment the temperature dependence of the pinning force is found to be f/sub p/ approx. (1 - T/T/sub c/)/sup 3/2/ near T/sub c/. There are two ingredients for the vortex depinning experiment. First, the N layer of the junction must be thick to reduce the field energy and dipole coupling force of the vortex. Secondly, vortex can be depinned at higher temperatures, at which depinning current is smaller than vortex nucleation current. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N88-10684# Rice Univ., Houston, Tex. Dept. of Chemical Engineering.
APPLICATION OF NEW CONFORMAL SOLUTION OF THEORIES Final Report, Jan. 1982 - Dec. 1985
T. W. Leland 11 May 1987 239 p
(Contract GRI-5082-260-0612)
(PB87-214557; GRI-86/0144) Avail: NTIS HC A11/MF A01 CSCL 20M

The objective of the project is to develop thermodynamic models to predict the properties of liquid and vapor mixtures such as equilibrium K-value and densities. The results of the project were the development of two expansion theories based on hard body equations of state: a Monte Carlo simulation study which generated distribution functions; a group contribution method to calculate activity coefficients; and nonanalytic equations of state for use in the critical region. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N88-10685# Sandia National Labs., Albuquerque, N. Mex.
DOCUMENTATION AS A MANAGEMENT STRATEGY FOR REACHING GOALS IN HIGH-RISK RESEARCH-ORIENTED PROJECTS
C. G. Shirley 1987 12 p Presented at the Project Management Institute Seminar/Symposium, Milwaukee, Wis., 2 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012394; SAND-86-2829C; CONF-8710103-2) Avail: NTIS HC A03

The paper reports experience bearing especially on construction projects in an R and D environment. From experience has come a set of principles about the key purposes of documentation. The paper first describes characteristics of a project environment that combines research and construction, then goes on to discuss basic project management goals that documentation can help the manager reach. The final sections present some specifics of documentation that may assist project managers who are considering what kind of documentation their projects need. DOE

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N88-10686*# Denver Univ., Colo. Program for the Management and Application of Science and Technology.
NASA'S NEW TECHNOLOGY REPORTING SYSTEM: A REVIEW AND FUTURE PROSPECTS
Richard L. Chapman Jun. 1985 205 p
(Contract NASw-3466)
(NASA-CR-180954; NAS 1.26:180954) Avail: NTIS HC A10/MF A01 CSCL 05B

A systematic effort is made to describe how NASA's new technology reporting system operates today, and how that system might be enhanced. The system is documented in terms of organization, operational practices, and other program benefits. Identified and assessed are incentives or disincentives to reporting, program management, program follow through, and the feasibility of various means for improving the general process. NASA has the only system in the Federal Government for capturing and disseminating new technology developed under its sponsorship of research and development. This system can be improved in many ways, some of which require additional resources and/or more senior management attention, but many of which can be instituted within the authority of the leadership of the Technology Utilization program. The suggested options and actions presented are mutually compatible. Any single action will contribute to improving the process. However, the first and most important step is undoubtedly to gain senior management's attention to the central role played by a vigorous new technology reporting system in the success and value of NASA's broader technology utilization and technology transfer activities. Author

N88-10687# Karlsruhe Univ. (West Germany). Falkutaet fuer Informatik.
OBJECT-ORIENTED DATA BASE MANAGEMENT FOR ROBOT PROGRAMMING [OBJEKTORIENTIERTE DATENHALTUNG FUER DIE ROBOTERPROGRAMMIERUNG]
Peter Dadam, Ruediger Dillmann, Alfons Kemper, and Peter C. Lockemann Nov. 1986 50 p In GERMAN; ENGLISH summary
(ETN-87-90367) Avail: NTIS HC A03/MF A01

The data base system Relational Robotics Database system with extensible data types is presented. A comprehensive robot programming system is discussed and analyzed with respect to the data modeling requirements, emphasizing the modeling of robots. The proposed technical data base management system, that can be used as a central data repository for a robot programming system, is based on the non-normalized relational data model NFz. This model allows the definition of arbitrary deep nested structures, providing a simple modeling concept for hierarchical relationships among data objects. Based on this data model an object-oriented user interface provides the facility to define new application-specific data types. ESA

N88-10688# University of North Florida, Jacksonville. Dept. of Computer Science.

HIGH PERFORMANCE CLAUSE INDEXING

R. Butler and R. Stevens 21 Feb. 1987 12 p Presented at the 4th Symposium on Logic Programming, San Francisco, Calif., 31 Aug. 1987 Prepared in cooperation with Argonne National Lab., Ill.

(Contract W-31-109-eng-38)

(DE87-011399; CONF-870899-2) Avail: NTIS HC A03/MF A01

Techniques used by most Prolog implementations for indexing clauses are too slow for applications that may have tens of thousands of clauses in a database. A preliminary implementation of clause indexing based on the idea of codewords is presented. In the present scheme the codeword indexing is used only for large in-memory clause databases and not for general Prolog procedures. Early experimental results suggest that this may be a way to effectively manage large numbers of structurally similar clauses. Some results on retrievals in a formula database of up to 11,000 clauses are presented. DOE

N88-10689# California Univ., Berkeley. Lawrence Berkeley Lab.

PROBLEMS IN INTEGRATING GEOGRAPHIC DATA

D. W. Merrill, Jr. May 1987 9 p Presented at the Piecing the Puzzle Together: A Conference on Integrating Data for Decisionmaking, Washington, D.C., 27 May 1987

(Contract DE-AC03-76SF-00098)

(DE87-012880; LBL-23601; CONF-8705147-3) Avail: NTIS HC A02/MF A01

Four major types of integrated data systems are: bibliographic, econometric, demographic, and composite. An example of the latter type is Lawrence Berkeley Laboratory's Socio-Economic Environmental Demographic Information System (SEEDIS). Selected SEEDIS data can be downloaded in various self-describing formats, for combination with the user's private data. The problem of combining data at different geographic levels (e.g., 1970 vs 1980 counties) is discussed. SEEDIS defines over 120 different levels and the relationships between them. Data can be automatically converted from one level to another with the use of geographic correspondence files. Data measured at discrete points, e.g., air quality, can be estimated for population units (e.g., census tracts) by various techniques including interpolation and two-dimensional weighted averaging. Density-equalizing map projections (cartograms) provide a means of analyzing geographic distributions when events are too sparse for reliable calculations of rates. DOE

N88-10690# Lawrence Livermore National Lab., Calif.

ABREGRAMS OR DELEWEDS: A FORTY-YEAR VIEW OF ACRONYMS

D. D. Bowden 29 May 1987 14 p Presented at the Institute of Electrical and Electronic Engineers Professional Communication Society Conference, Winnipeg, Manitoba, 14 Oct. 1987

(Contract W-7405-eng-48)

(DE87-010808; UCRL-96697; CONF-871086-1) Avail: NTIS HC A03/MF A01

New concepts often call for new words and abbreviated forms in the language. Not linguists, but persons who first envision, describe, and use new ideas are the ones who rearrange existing word combinations or create new terminology. Professional communicators do not prescribe usage, but can influence the selection of new words and especially acronyms. A practical knowledge of etymology, usage, and trends will help communicators make more discriminating choices. DOE

N88-10691# California Univ., Berkeley. Lawrence Berkeley Lab.

A NEW COMPRESSION METHOD WITH FAST SEARCHING ON LARGE DATABASES

J. Z. Li, D. Rotem, and H. K. T. Wong Mar. 1987 23 p Presented at the 13th International Conference on Very Large Data Bases, Brighton, England, 1 Sep. 1987

(Contract DE-AC03-76SF-00098)

(DE87-010986; LBL-22393; CONF-870996-1) Avail: NTIS HC A03/MF A01

A new compression method for constant removal from very large scientific and statistical databases is presented. The new method combines the best features from several classical constant removal compression methods. The result, both analytical and experimental, shows that the method is superior to these popular methods in terms of compression effectiveness and efficient searching on the compressed data. In addition to the development, analysis and validation of this new method, this paper also presents analysis of several traditional constant removal methods for the purpose of analytic comparison. A large collection of experiments has been designed and run to observe and validate the behavior of the compression methods. Another contribution of the paper is that performance characteristics are identified for different compression methods under different data properties assumptions. The result can be used as a basis for selecting compression methods by matching the properties of the database at hand to the data properties experimented in the paper. DOE

N88-10692*# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

LOCAL CONCURRENT ERROR DETECTION AND CORRECTION IN DATA STRUCTURES USING VIRTUAL BACKPOINTERS

C. C. Li, P. P. Chen, and W. K. Fuchs Oct. 1987 42 p

(Grant NAG1-602)

(NASA-CR-181432; NAS 1.26:181432; UILU-ENG-87-2264; CSG-73) Avail: NTIS HC A03/MF A01 CSCL 05B

A new technique, based on virtual backpointers, for local concurrent error detection and correction in linked data structures is presented. Two new data structures, the Virtual Double Linked List, and the B-tree with Virtual Backpointers, are described. For these structures, double errors can be detected in 0(1) time and errors detected during forward moves can be corrected in 0(1) time. The application of a concurrent auditor process to data structure error detection and correction is analyzed, and an implementation is described, to determine the effect on mean time to failure of a multi-user shared database system. The implementation utilizes a Sequent shared memory multiprocessor system operating on a shared databased of Virtual Double Linked Lists. Author

N88-10693 Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Informatique.

FILE MANAGEMENT USING BALANCED TREES [GESTION DE FICHIERS AU MOYEN DES ARBRES BALANCES]

Alexandre Zenie, Francis Lecam, and Yves Pla Jan. 1987 94 p In FRENCH

(ENST-87D001; ISSN-0751-1345; ETN-87-90658) Avail: NTIS HC A05

A computer program for large real time stock management data base systems is designed. The balanced tree concept is used to diminish the access time and to maximize the utilization of the auxiliary memory, reducing that of the central memory. The procedures are listed and described. The developed program, is written for Unix systems. The listing is included. ESA

N88-10097*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA MANAGEMENT WORKING GROUP REPORT
Edward J. Filardo (Rockwell International Corp., Seal Beach, Calif.) and David B. Smith *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 177-186 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N88-10694# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OPTIMIZATION OF A CONTROLLED TWO-SERVER MAINTENANCE SYSTEM
Paulo RenatodeMorais and Solon VenanciodeCarvalho Jun. 1987 19 p Presented at the 11th Triennial Conference on Operations Research, Buenos Aires, Argentina, 10-14 Aug. 1987
(INPE-4202-PRE/1083) Avail: NTIS HC A03/MF A01

A maintenance system is considered consisting of a finite number of identical machines at a production facility, a finite number of spare machines, and a two-server repair facility. At decision points, there are three possible actions: use the fast server, use the slow server, or use both servers to repair the broken machine. There are holding costs, repair costs, lost production costs, and switch-over costs to be considered. The objective is to choose the actions optimally in order to minimize the long-term anticipated average cost per unit. Author

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N88-10695# RAND Corp., Santa Monica, Calif.
NEW TECHNOLOGIES AND INTELLECTUAL PROPERTY: AN ECONOMIC ANALYSIS
Stanley M. Besen May 1987 81 p
(Grant NSF IST-84-15297)
(N-2601-NSF) Avail: NTIS HC A05/MF A01

A greater understanding was developed of how new information and communications technologies may affect the economic system in which knowledge based products and services are created, produced, packaged, distributed, and used. Examined are: (1) the economic basis for the systems of private property rights in intellectual property, copyrights, patents, and trade secrets; (2) the economic behavior of producers of intellectual property; (3) the effects of new technologies on that behavior; (4) the effects of the legal treatment of authors, publishers, packagers, distributors, and users; (5) the issues involved in estimating the harm to producers of intellectual property that results from the introduction of new technologies; and (6) various types of government intervention that may be used to promote the supply of intellectual property. Author

N88-10696# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
BUDGET REIMBURSEMENTS: THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S REIMBURSABLE WORK
Jun. 1987 19 p
(PB87-207296; GAO/NSIAD-87-171FS; B-227311) Avail: NTIS HC A03/MF A01 CSCL 05C

The fact sheet responds to a congressional request for information about the National Aeronautics and Space Administration's (NASA) reimbursement. It: (1) describes how reimbursements impact on NASA's funding requirements; (2) provides the amount of estimated total reimbursements for fiscal year 1987; and (3) provides information on the amount, type, and source of reimbursements in fiscal year 1985 for the Space Flight Control and Data Communications and Research development accounts. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N88-10697# National Aerospace Lab., Amsterdam (Netherlands).
AEROSPACE RESEARCH AT THE NATIONAL AEROSPACE LABORATORY (NLR)
1987 40 p Original contains color illustrations
(ETN-87-90821) Avail: NTIS HC A03/MF A01

Research in fluid dynamics (wind tunnel tests, computational aerodynamics, unsteady aerodynamics, aeroacoustics, propulsion); flight (handling qualities, aircraft performance, flight tests, systems, flight simulation, certification, air traffic control, human factors engineering); aerospace structures and materials; satellite control; remote sensing; robotics; microgravity; and computing science is described. ESA

N88-10698# Office of Naval Research, London (England).
THE BRITISH TECHNOLOGY GROUP
J. F. Blackburn 17 Aug. 1987 12 p
(ONRL-7-022-R) Avail: NTIS HC A03/MF A01

The British Technology Group, when it was established in 1981, incorporated the National Research Development Corporation and the National Enterprise Board. Its primary purpose is to encourage and facilitate transfer of new ideas and technology from university and government laboratories to industry. This report reviews the Group's current activities, among which are the following: genetic engineering; veterinary medicine; biotechnology; chemical engineering; computer science; speech recognition; amorphous silicon; image processing; and computer aided design. Author

N88-10699# Los Alamos National Lab., N. Mex.
DOT FUEL-CELL-POWERED BUS FEASIBILITY STUDY Final Report, Dec. 1986
H. S. Murray, J. R. Huff, J. F. Roach, and G. R. Thayer Jun. 1987 372 p
(Contract W-7405-eng-36)
(DE87-012705; LA-10933-MS) Avail: NTIS HC A16

The purpose of this study was to evaluate and document the feasibility of powering standard size (40 ft) and small (25 to 30 ft) buses with fuel cells. Present status of fuel cell systems was documented and fuel cell development over the next five years was projected. Preferred propulsion systems consisting of pure fuel cells and fuel cell/battery hybrids were identified. Performance modeling was performed using DOT drive cycles for the standard bus and a Georgetown University route for the small bus. A life cycle cost analysis was performed to determine break-even costs for the fuel cell system compared to conventional diesel-powered buses. It was concluded that a functional, hybrid fuel cell/battery powered bus can be built with currently available technology to meet the requirements of the reduced power DOT drive cycle and, with some lowered top speeds, to meet the Georgetown University route requirements. To break even with a diesel bus, fuel cell and reformer costs should be in the range of $200 to $500/kW. No dollar value was placed on the fuel cell's low air and noise pollution. A future development plan was prepared based on this study. DOE

N88-10700*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RE-1000 FREE-PISTON STIRLING ENGINE HYDRAULIC OUTPUT SYSTEM DESCRIPTION
Jeffrey G. Schreiber and Steven M. Geng Oct. 1987 21 p (NASA-TM-100185; E-3802; NAS 1.15:100185) Avail: NTIS HC A03/MF A01 CSCL 13I

The NASA Lewis Research Center was involved in free-piston Stirling engine research since 1976. Most of the work performed in-house was related to characterization of the RE-1000 engine. The data collected from the RE-1000 tests were intended to provide a data base for the validation of Stirling cycle simulations. The RE-1000 was originally build with a dashpot load system which did not convert the output of the engine into useful power, but was merely used as a load for the engine to work against during testing. As part of the interagency program between NASA Lewis and the Oak Ridge National Laboratory, (ORNL), the RE-1000 was converted into a configuration that produces useable hydraulic power. A goal of the hydraulic output conversion effort was to retain the same thermodynamic cycle that existed with the dashpot loaded engine. It was required that the design must provide a hermetic seal between the hydraulic fluid and the working gas of the engine. The design was completed and the hardware was fabricated. The RE-1000 was modified in 1985 to the hydraulic output configuration. The early part of the RE-1000 hydraulic output program consisted of modifying hardware and software to allow the engine to run at steady-state conditions. A complete description of the engine is presented in sufficient detail so that the device can be simulated on a computer. Tables are presented showing the masses of the oscillating components and key dimensions needed for modeling purposes. Graphs are used to indicate the spring rate of the diaphragms used to separate the helium of the working and bounce space from the hydraulic fluid. Author

N88-10087*# Department of the Air Force, Andrews AFB, Md.
MILITARY NEEDS AND FORECAST, 2
Alan B. Goldstayn *In* NASA-Lewis Research Center, Spacecraft 2000 Jul. 1986 p 11-25 (For primary document see N88-10084 01-18)
Avail: NTIS HC A11/MF A01 CSCL 12B

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N88-10701# European Southern Observatory, Garching (West Germany).
[ACTIVITIES REPORT IN ASTRONOMY] Annual Report, 1986
D. L. Woltjer 1986 98 p In ENGLISH, FRENCH, and GERMAN Original contains color illustrations
(ISSN-0531-4496; ETN-87-90798) Avail: NTIS HC A05/MF A01

Progress in installing equipment at the European Southern Observatory in Chile, and research programs are summarized. Observations of Halley's comet, Charon, the Galilean satellites, interstellar space, variable stars, X-ray binaries, radial velocities, radio galaxies and quasars, supernovae, and HII regions are described. The status of the Sky Survey is reported. ESA

N88-10702# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
AN APPLICATION OF L1 TO ASTRONOMY
Peter J. Rousseeuw 1987 19 p
(Rept-87-10; B8709670; ISSN-0920-8577; ETN-87-90843)
Copyright Avail: NTIS HC A03/MF A01

Use of L1 statistics to derive stellar velocity from Doppler shifts in stellar spectra is explained. The method is more robust than traditional techniques and is very powerful for analyzing complicated spectra. ESA

N88-10052# Joint Publications Research Service, Arlington, Va.
X-RAY ASTRONOMY INSTRUMENTS TO OPERATE ON MIR STATION
Tamara Breus *In its* USSR Report: Space 22 Apr. 1987 p 50-51 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 21, 5 Nov. 1986 p 1-3 (For primary document see N88-10050 01-12)
Copyright Avail: NTIS HC A08/MF A01

N88-10618# National Radio Astronomy Observatory, Socorro, N. Mex.
IMAGING AT RADIO WAVELENGTHS
T. J. Cornwell *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 31-36 Sponsored by NSF (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10619# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Physik.
ISIS: IMAGE RECONSTRUCTION METHODS AND SIGNAL-TO-NOISE RATIO INVESTIGATIONS
K.-H. Hofmann and G. Weigelt *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 37-39 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10620# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Physik.
ISIS: IMAGE RECONSTRUCTION EXPERIMENTS AND COMPARISON OF VARIOUS ARRAY CONFIGURATIONS
T. Reinheimer, K.-H. Hofmann, and G. Weigelt *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 41-43 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10621# Observatoire de Toulouse (France).
ON THE CONCEPT OF RESOLUTION ELLIPSE IN APERTURE SYNTHESIS MATCHED DECONVOLUTION WITH ERROR ANALYSIS
A. Lannes and S. Roques *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 45-48 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10622# Netherlands Foundation for Radio Astronomy, Dwingelo.
OASIS: A MISSION CONCEPT
J. E. Noordam, A. H. Greenaway, J. D. Bregman, and R. S. lePoole (Leiden Univ., Netherlands) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 51-59 (For primary document see N88-10613 01-74)
(Grant NATO-723/84)
Copyright Avail: NTIS HC A11/MF A01

N88-10624# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
BINARY STAR EXPLORER
Wesley A. Traub *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 67-68 Sponsored by the Smithsonian Inst. Scholarly Studies Program (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10635# Consiglio Nazionale delle Ricerche, Milan (Italy). Ist. di Fisica Cosmica.
ON THE (LACK OF) PROPER MOTION OF THE VELA PULSAR

P. A. Caraveo, G. F. Bignami, and G. Vacanti *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 151-154 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10638# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
APERTURE SYNTHESIS IN SPACE: TECHNICAL PROBLEMS
D. Morancais and P. Roussel (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 177-185 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

N88-10703# Los Alamos National Lab., N. Mex.
MODES, MASSES, METALLICITIES, AND MAGNITUDES OF RR LYRAE VARIABLES
A. N. Cox 1 Jul. 1987 12 p Presented at the IAU Colloquium 95, Tucson, Ariz., 1 Jun. 1987
(Contract W-7405-eng-36)
(DE87-013149; LA-UR-87-2314; CONF-8706143-3) Avail: NTIS HC A03/MF A01

The author reviews past and recent developments in the study of RR Lyrae variables. He provides supporting evidence for a large helium content but remains uncertain as to their masses and luminosities. Time dependent convection is offered as a probable explanation for the double mode pulsations of these stars. DOE

N88-10704# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
SPONTANEOUS SYMMETRY BREAKING IN N=2 SUPERGRAVITY
Yu. M. Zinovev 1986 8 p
(DE87-702749; IFVE-OTF-86-126) Avail: NTIS (US Sales Only) HC A02/MF A01

A model describing the N=2 supergravity interaction with vector and linear multiplets is constructed. It admits the introduction of the spontaneous breaking of supersymmetry with arbitrary scales, one of which may be equal to zero, which corresponds to partial super-Higgs effect (N=2 -> N=1). A cosmological term is automatically equal to zero. DOE

N88-10705# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
SPONTANEOUS SYMMETRY BREAKING IN N=3 SUPERGRAVITY
Yu. M. Zinovev 1986 14 p
(DE87-702753; IFVE-OTF-86-171) Avail: NTIS (US Sales Only) HC A03/MF A01

The possibility of the spontaneous symmetry breaking without a cosmological term in N=3 supergravity is investigated. A new, dual version of N=3 supergravity - U(3)-supergravity is constructed. Such a theory is shown to admit a spontaneous supersymmetry breaking without a cosmological term and with three arbitrary scales, including partial super-Higgs effect N=3 yields N=2 and N=3 yields N=1. DOE

N88-10706# Heidelberg Univ. (West Germany). Naturwissenschaftlich-Mathematischen Gesamfakultaet.
DYNAMIC EFFECTS OF STELLAR WINDS AND ASSOCIATED HII REGIONS ON THE INTERSTELLAR MEDIUM Ph.D. Thesis [DYNAMISCHE EFFEKTE VON STELLAREN WINDEN UND MIT IHNEN ASSOZIIERTEN HII - REGIONEN AUF DAS INTERSTELLARE MEDIUM]
Dieter Breitschwerdt 1985 113 p In GERMAN
(ETN-87-90421) Avail: NTIS HC A06/MF A01

A dynamic model, describing the time evolution of a stellar wind and its associated HII region, was developed. A system of nonlinear, ordinary differential equations and algebraic equations which can be numerically integrated without large computer time was deduced. Model calculations show that the time evolution has to be divided into three phases. An equation for the motion of an ionization front in the first two phases was deduced. The interaction between ionization front and shock front, occurring at the end of the second phase, was treated as a Riemann problem. The effect of dust on the dynamics of HII regions is found to be largest for high gas densities. The cooling of the shocked hot wind region was determined. The proposed model allows the determination of the flow structure in the neighborhood of young stars, and other astrophysical flows with discontinuities. ESA

N88-10707# Heidelberg Univ. (West Germany). Naturwissenschaftlich-Mathematischen Gesamfakultaet.
ANALYSIS OF THE CARBON STAR G77-61 Ph.D. Thesis [ANALYSE DES KOHLENSTOFFSTERNES G77-61]
Hans Gas 1985 109 p In GERMAN
(Contract DFG-SFB-132)
(ETN-87-90422) Avail: NTIS HC A06/MF A01

The carbon star G77-61 was investigated using model calculations. Observational data on G77-61 is presented. The computer program for the construction of model atmospheres is described. The mass estimation of carbon stars is discussed. It is shown that an observed spectrum allows ambiguity concerning the stellar parameter. The parameters of G77-61 were determined using observation data. The error bars of the resulting data are discussed, especially the deviations between spectroscopic and other data. The consequences of the obtained parameters, and especially the very low abundance of metals, for the development of G77-61, are discussed. ESA

N88-10643# Universidad de la Laguna (Spain). Inst. de Astrofisica de Canarias.
IMAGE SHARPENING OBSERVATIONS OF ACTIVE GALACTIC NUCLEI
A. CamposAguilar, I. Perez-Fournon, and J. M. Carranza (Royal Greenwich Observatory, Hailsham, England) *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 221-225 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10644# European Southern Observatory, Garching (West Germany).
GALACTIC NUCLEI AND QUASARS AT HIGH ANGULAR RESOLUTION
M. H. Ulrich *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 227-231 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

N88-10736*# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmntal Sciences.
DYNAMICS OF MAGNETIC CLOUDS IN INTERPLANETARY SPACE Abstract Only
Tyan Yeh *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 31 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10737*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EXPANSION OF MAGNETIC CLOUDS Abstract Only
Steven T. Suess *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 32 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10741*# Los Alamos National Lab., N. Mex.
AN OVERVIEW OF STIP INTERVAL 18: SEPTEMBER 1985, THE G-Z ENCOUNTER Abstract Only
R. D. Zwickl *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 37 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10742*# Universidad Nacional Autonoma de Mexico, Ensenada.
COMPARATIVE PLASMA TAILS OF VENUS AND COMETS Abstract Only
H. PerezdeTejada *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 38 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10744*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE STATUS OF THE INTERNATIONAL HALLEY WATCH Abstract Only
Ray L. Newburn, Jr. and Juergen Rahe (Erlangen-Nuremberg Univ., West Germany) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 40 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10746*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
THE GLOBAL INTERACTION OF COMETS WITH THE SOLAR WIND Abstract Only
Harry L. F. Houpis *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 41 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10749*# California Univ., San Diego, La Jolla.
COMET WEST: A VIEW FROM THE HELIOS ZODIACAL LIGHT PHOTOMETERS Abstract Only
R. M. Benensohn and B. V. Jackson *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 46 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10754*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
EQUILIBRIUM AND TEARING STABILITY OF THIN CURRENT LAYERS IN MAGNETIC ARCADES Abstract Only
A. B. Hassam *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 53 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

N88-10759*# Academy of Sciences (USSR), Moscow.
INTERSHOCK OBSERVATIONS DURING STIP INTERVALS 17 AND 18
G. Zastenker, N. Borodkova, Yu. Yermolayev, V. Zhuraviev, V. Lutsenko, S. Klimov, S. Fischer, M. Vandas, K. Kudela, and M. Slivka (Kosice Technical Univ., Czechoslovakia) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 58 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N88-10708# Lawrence Livermore National Lab., Calif.
ELECTRICAL CONDUCTIVITY AND EQUATION OF STATE MEASUREMENTS ON PLANETARY FLUIDS AT HIGH PRESSURES AND TEMPERATURES
D. C. Hamilton, W. J. Nellis, N. C. Holmes, H. B. Radousky, F. H. Ree, and M. Nicol Jul. 1987 5 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987 Prepared in cooperation with California Univ., Los Angeles
(Contract W-7405-eng-48)
(DE87-013787; UCRL-96523; CONF-870753-65) Avail: NTIS HC A02

Hugoniot equation-of-state, shock temperature, and electrical conductivity measurements are reported for fluids believed to be the primary constituents of the planets Uranus and Neptune. The equation-of-state results are compared with calculations performed using a statistical mechanical, chemical equilibrium computer code and electrical conductivities are discussed in terms of the recently measured magnetic field of Uranus. DOE

N88-10054# Joint Publications Research Service, Arlington, Va.
VENUSIAN SURFACE AND CRUST
V. L. Barsukov and Yu. A. Surkov *In its* USSR Report: Space 22 Apr. 1987 p 75-91 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 3-15 (For primary document see N88-10050 01-12)
Copyright Avail: NTIS HC A08/MF A01

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

N88-10709*# Alabama Univ., Huntsville. Center for Space Plasma and Aeronomic Research.
STIP SYMPOSIUM ON PHYSICAL INTERPRETATION OF SOLAR/INTERPLANETARY AND COMETARY INTERVALS Final Report, 1 Apr. - 30 Sep. 1987 Abstracts Only
S. T. Wu 14 Sep. 1987 73 p Symposium held in Huntsville, Ala., 12-15 May 1987
(Grant NAGw-1117)
(NASA-CR-181201; NAS 1.26:181201) Avail: NTIS HC A04/MF A01 CSCL 03B

The study of travelling interplanetary phenomena has continued over a period of years. The STIP (Study of Travelling Interplanetary Phenomena) Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals was held in Huntsville, Alabama, on May 12-15, 1987, the first of these meetings to be held in the United States. The Symposium's objective was to coordinate and disseminate new science gained from the recent solar-terrestrial and cometary intervals which can be used to better understand the linkage of physical events to the Sun's vagaries (flares, coronal holes, eruptive prominences) from their initial detection to their consequence. Fifty-one presentations were made during the four-day period. Abstracts of these reports are included as Appendix A. For individual titles, see N88-10710 through N88-10759.

N88-10710*# Air Force Geophysics Lab., Hanscom AFB, Mass.
OVERVIEW OF STIP INTERVALS 15-19 Abstract Only
M. A. Shea and M. Dryer (National Oceanic and Atmospheric Administration, Boulder, Colo.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 2 (For primary

document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Five STIP Intervals for special scientific study of solar and interplanetary phenomena were designated between February 1984 and March 1986. The first two intervals were selected retrospectively after unusual periods of solar activity; the remaining three intervals were selected in advance in conjunction with anticipated spacecraft configurations and measurements. In this overview the historical background of these STIP Intervals and a summary of the rationale in the selection of these particular time periods for concentrated studies are presented. Author

N88-10711*# California Univ., Berkeley. Space Sciences Lab.
SOLAR-TERRESTRIAL OBSERVATIONS DURING STIP INTERVAL 15 (12-21 FEBRUARY 1984) Abstract Only
S. R. Kane *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 3 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

STIP interval XV covered the time period 12-21 February, 1984. Several large solar flares occurred during this period, the most significant being that on 16 February (0900 UT). Although this flare occurred about 40 deg behind the west limb of the Sun, both the occulted and the unocculted hard x-ray emission was obseved by instruments aboard spacecraft. The occulted radio emission and terrestrial effects were observed by several ground-based observatories. The flare produced energetic particles with energies up to several GeV. In spite of the location of the flare far behind the west limb, the high-energy particles produced a prompt and rapid increase in the ground-level neutron monitor rates. Observations of the solar-terrestrial effects of this and other flares during STIP interval XV are summarized and some of the implications of these new observations with respect to the acceleration and propagation of energetic solar particles and the role of flare-generated shocks will be discussed. Author

N88-10712*# National Geophysical Data Center, Boulder, Colo. World Data Center A for Solar-Terrestrial Physics.
OVERVIEW OF THE MONSEE UAG REPORT ON STIP INTERVALS NO. 15 AND 16: THE 24-25 APRIL 1984 FORBUSH DECREASE PERIOD Abstract Only
Helen E. Coffey and Joe H. Allen *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 4 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The solar-terrestrial activity of 24-25 April 1894 is reviewed based on the MONSEE UAG-96 Report Solar-Geophysical Activity Reports for STIP Interval XVI 12-21 February 1984 Ground Level Event and STIP Interval XVI 20 April- 4 May 1984 Forbush Decrease (Helen E. Coffey and Joe H. Allen, compilers). A large 3B/X13.0 solar flare at 2356 UT on 24 April 1984 from the S11 E45 Solar Active Region (AR) 4474 produced major interplanetary and terrestrial environmental changes. The solar activity, the event itself, and the consequential, though temporary changes in the interplantary environment, in the near Earth space environment, and in the Earth's ionosphere and magnetic filed are discussed. For the Study of Travelling Interplanetary Phenomena (STIP) Symposium, emphasis will be placed on the solar, interplanetary, and cosmic ray observations. Author

N88-10713*# Air Force Geophysics Lab., Hanscom AFB, Mass.
LOW ALTITUDE FLUX AND DOSE MEASUREMENTS DURING TWO SOLAR FLARE EVENTS Abstract Only
D. H. Brautigam, M. S. Gussenhoven, E. G. Mullen, and M. R. Oberhardt *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 5 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The dosimeter on board the low altitude polar orbiting DMSP/F7 satellite makes dose and flux measurements for electrons with energies greater than 1.0, 2.5, 5.0 and 10.0 MeV; and for protons with energies greater than 20, 35, 51, and 75 MeV. The characteristics and performance of the dosimeter are illustrated by presenting dose and flux data taken during the solar flare proton events of February 16 and April 26, 1984. Author

N88-10714*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LARGEST WHITE LIGHT FLARE EVER OBSERVED: 25 APRIL 1984, 0001 UT Abstract Only
D. F. Neidig, H. Grosser, and A. L. Kiplinger *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 6 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The X13/3B flare of 25 April 1984, 0001 UT, was accompanied by intense white light emission that reached a peak power output approx 2x10 to the 29 erg/sec in the optical/near UV continuum; the total energy radiated in the continuum alone reached 10 to the 32 power ergs. This was the most powerful white light flare yet recorded, exceeding the peak output of the largest previously known event by more than one order of magnitude. The flare was a two-ribbon type with intense embedded kernels as observed in both Balmer-alpha line and Balmer continuum, and each of these flare ribbons covered separate umbrae shortly after the maximum of the event. The onset and peak of the white light emission coincided with the onset and peak of the associated E greater than 100 KeV hard X-ray burst, while the 1-8 angstrom soft X-ray emission reached its maximum 4 minutes after the peak in white light. Author

N88-10715*# Air Force Geophysics Lab., Hanscom AFB, Mass.
PROBABLE DETECTION OF SOLAR NEUTRONS BY GROUND-LEVEL NEUTRON MONITORS DURING STIP INTERVAL 16 Abstract Only
M. A. Shea, D. F. Smart, and E. O. Flueckiger (Bern Univ., Switzerland) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 7 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The third solar neutron event detected by Earth-orbiting spacecraft was observed during STIP Interval XVI. The solar flare beginning at 2356 UT on 24 April I984 produced a variety of emissions including gamma rays and solar neutrons. The neutrons were observed by the SMM satellite and the neutron-decay protons were observed on the ISEE-3 spacecraft. Between 0000 and 0010 UT on 25 April an increase of 0.7 and 1.7 percent was recorded by neutron monitors at Tokyo (Itabashi) and Morioka, Japan. These stations were located about 42 degrees from the sub-solar point, and consequently, these is approximately 1400 grams of atmosphere between the incident neutrons at the top of the atmosphere and their detection on the Earth's surface. Nevertheless, the time coincidence of a small increase in the total counting rate of two independent neutron monitors indicates the presence of solar neutrons with energies greater than 400 MeV at the top of the Earth's atmosphere. The small increases in the counting rate emphasize the difficulty in identifying similar events using historical neutron monitor data. Author

N88-10716*# Academy of Sciences (USSR), Moscow.
SOLAR ENERGETIC PARTICLES EVENTS OBSERVED BY PROGNOZ-10 INTERCOSMOS (MAY-OCTOBER 1985) Abstract Only
V. Lutserko, S. Fischer, M. Vandas, K. Kudela, and M. Stivka (Kosice Technical Univ., Czechoslovakia) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 8 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

On 26 April 1985, Intershock began observation of a solar energetic particle (SEP) event, resulting from a 3B solar flare which originated on 24 April. The following observation period was quiet

with only a few weak increases of low-energy protons of several days duration. Two prominent SEP events occurred on 9 July 1985 (start 0133 UT, position S13, W25) and 17 July (no optical data, type II radio burst from 0333 to 0348 UT). These mass ejection and particle propagation episodes were studied on the basis of X-ray, radio, and energetic particle emissions. F.M.R.

N88-10717*# Tuebingen Univ. (West Germany). Astronomical Inst.

THE LARGE TYPE 4 RADIO BURST EVENT OF 24 APRIL 1985 INTERPRETED BY DYNAMIC SPECTRAL RECORDINGS AND ASSOCIATED RECORDINGS Abstract Only

H. W. Urbarz *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 10 (For primary document see N88-10709 01-92)

Avail: NTIS HC A04/MF A01 CSCL 03B

The Active Region 4647 showed a sudden increase in spot area on 23 April 1985 as well as an appearance of the D magneic configuration. During STIP interval XVII numerous subflares occurred in this region but only one very large event which exhibited all signatures of a classical p-event, well separated in time from other large events. The dynamic spectrum was observed at Bleien, Ondrejov, and Weissenau. The onset of radiation at m- and dm-waves is impulsive, and at dm-waves the preceeding dm continuum rises gradually. The absolute fluxes show very high readings of some 10 to the 4th power SFU at m-waves and some 5 x 10 to the 3d power at cm waves. High energy particles were observed about a day later by IMP 8. A Forbush decrease was seen on the neutron monitors but there was no GLE. The GOES X-ray flux monitors showed a gradual rise to high fluxes and a slow decrease over several hours. This information was extracted from Gdata but also from numerous letters from other observers and interpreters. More detailed data on the event and on the concomitant active region are to be presented. Author

N88-10718*# Observatoire de Paris-Meudon (France).

PROPAGATING SHOCKS IN THE CORONA Abstract Only

Yolanda Leblanc *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 11 (For primary document see N88-10709 01-92)

Avail: NTIS HC A04/MF A01 CSCL 03B

High resolution observations performed with the Decimeter spectrograph and the multichannel receiver at Nancay were analyzed in the range of 25-75 MHz. Sixty Type II bursts were selected. In this frequency range, type II events are generally associated with other radio emissions (such as storms of type III-U-I bursts); they are preceeded or followed by groups of U-bursts. One third of type II events show a nonuniform frequency drift, usually a steep decrease followed by an abrupt increase. This phenomenon can be explained by the propagation of an extended disturbance through the ambient corona when the density gradient is enhanced. An empirical coronal model is proposed to interpret these observations. The observations at fixed frequency of Type II bursts including fundamental and harmonic components are analyzed. It is shown that the spectrum of the intensity fluctuations differs with the fundamental and the harmonic components. The origin of these differences is discussed. Author

N88-10719*# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

CHANGE IN INTERPLANETARY SHOCK ACCELERATION PRECEDING STIP INTERVAL 17 Abstract Only

R. E. Gold, R. B. Decker, L. J. Lanzerotti, and C. G. Mclennan (Bell Telephone Labs., Inc., Murray Hill, N. J.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 12 (For primary document see N88-10709 01-92)

Avail: NTIS HC A04/MF A01 CSCL 03B

The intensity and frequency of shock acceleration events in the interplanetary medium decreased dramatically in early 1985. Low energy ions were observed by IMP 8 at 1 AU and Voyagers 1 and 2 at 22 and 16 AU, respectively. Voyager 1 was at 25 deg heliographic latitude while IMP 8 and Voyager 2 were near the solar equatorial plane. The decrease in low energy shock events led to a drop in the average ion flux by a factor of 20 to 50. It started about day 10 of 1985 in the approximately .5 MeV channel on IMP8 and took approximately 75 days to reach the new, lower, background level. The decrease at the Voyagers started approximately 50 days later. The time delay between the start of the decrease at IMP and at Voyager 2 implies that decrease was convected outward with a velocity of approximately 535 km/sec. The intensity and frequency of interplanetary shock events remained at the lower level for at least 1.5 years. Author

N88-10720*# Chicago Univ., Ill.

SOLAR MODULATION OF THE COSMIC RADIATION IN THE HELIOSPHERE Abstract Only

R. B. McKibben *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 13 (For primary document see N88-10709 01-92)

Avail: NTIS HC A04/MF A01 CSCL 03B

Changes in the solar modulation of galactic and anomalous component cosmic rays reflect changes in the structure and magnetic topology of the interplanetary medium. Therefore, to the extent that the modulation process is understood, the cosmic rays can be used as a probe of the medium to infer the extent and structure of the heliosphere in regions not directly sampled by spacecraft. The challenge to modulation theory and observation has been to determine which properties of the solar wind are most important for producing the observed modulation. Significant progress has been made in answering this question during the last solar cycle using observations from spacecraft at radii to 40 AU from the Sun and at latitudes up to 30 degrees with respect to the ecliptic. A brief summary of new results and observations (with specific attention to the STIP intervals XV-XIX) will be presented to illustrate the present state of our understanding of the relation between the solar wind and interplanetary magnetic field and the modulations of the cosmic radiation. Author

N88-10721*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EVOLUTION OF THE SOLAR WIND STRUCTURE IN THE OUTER HELIOSPHERE Abstract Only

Y. C. Whang (Catholic Univ. of America, Washington, D.C.) and L. F. Burlaga *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 14 (For primary document see N88-10709 01-92)

Avail: NTIS HC A04/MF A01 CSCL 03B

Shocks and interaction regions play very important roles in the evolution of large-scale solar wind structure in the outer heliosphere. This study is based on (1) plasma and magnetic field data observed from Voyager and Pioneer spacecraft, and (2) a quantitative magnetohydrodynamic simulation model. Interaction regions bounded by a forward and a reverse shock begin to form near 1 AU at the leading edges of a large-scale stream. The total pressure in the region is greater than the ambient pressure by a factor of ten or more. Large jumps in pressure remain as a prominant feature of the interplanetary structure even as the jumps in flow speed become less visible in the outer heliosphere. The propagation of the forward and reverse shocks widens the dimension of an interaction region. As a result, two interaction regions belonging to neighboring streams coalesce to form a merged interaction region (MIR). Collision and merging of shocks take place during the coalescence process. Two MIRs can themselves merge again at greater heliocentric distances. Simulation results agree well with spacecraft observations, and they explain major restructuring of the solar wind in the outer heliosphere. Author

N88-10722*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
COMPARISON OF MHD SIMULATION FOR THE FEBRUARY 1986 EVENTS WITH INTERPLANETARY OBSERVATIONS BY THE SPACECRAFT SAKIGAKE Abstract Only
Z. Smith, T. Yeh, M. Dryer, T. Watanabe, and K. Oyama (Tokyo Univ., Japan) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 15 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

During the period 3-10 February 1986 a series of major solar flares occurred on the Sun and several intense geomagnetic storms took place on the Earth. To examine the causality between the solar activity and the geomagnetic activity in this period, a magnetohydrodynamic (MHD) numerical simulation was performed using a 2 1/2 -D numerical code. In that period of February 1986, the Japanese spacecraft Sakigake was at 0.84 AU, 57 deg west of the Earth. Besides the in-situ measurements of the interplanetary plasma, Sakigake also provided Doppler scintillation observations. Comparisons between the results of the MHD simulation and the measurements made by the spacecraft Sakigake are presented.
Author

N88-10723*# Maryland Univ., College Park. Astronomy Program.
TWO DIMENSIONAL IMAGING OBSERVATIONS OF METER-DECAMETER BURSTS ASSOCIATED WITH THE FEBRUARY 1986 FLARE ACTIVITY Abstract Only
N. Gopalswamy and M. R. Kundu *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 16 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

An analysis is presented of the two dimensional imaging observations of a flare observed on 3 Feb. 1986 using the Clark Lake Multifrequency Radioheliograph. The flare produced almost all types of Meter-decimeter radio emission: enhanced storm radiation, type III/V bursts, II and IV and flare continuum. The flare continuum had early (FCE) and late (FC II) components and the type II occurred during the period between these two components. Comparing the source positions of type III/V and FCE it was found that these bursts must have occurred along adjacent open and closed field lines, respectively. The positional analysis of type II and FC II implies that the nonthermal electrons responsible for FC II need not be accelerated by type II shock and this conclusion is further supported by the close association of FC II with a microwave peak. Using the positional and temporal analysis of all these bursts and the associated hard X-ray and microwave emissions, a schematic model is developed for the magnetic field configuration in the flaring region in which the nonthermal particles responsible for these bursts are confined or along which they propagate.
Author

N88-10724*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
MAGNETIC FIELD TWIST DRIVEN BY REMOTE CONVECTIVE MOTIONS: CHARACTERISTICS AND TWIST RATES Abstract Only
Zheng-Zhi Wang and A. B. Hassam *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 17 (For primary document see N88-10709 01-92)
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It is generally believed that convective motions below the solar photosphere induce a twist in the coronal magnetic field as a result of frozen-in physics. A question of interest is how much twist can one expect from a persistent convective motion, given the fact that dissipative effects will eventually figure. This question is examined by considering a model problem: two conducting plates, with finite resistivity, are set in sheared motion and forced at constant relative speed. A resistive plasma is between the plates and an initially vertical magnetic field connects the plates. The time rate of tilt experienced by the field is obtained as a function of Hartmann number and the resistivity ratio. Both analytical and numerical approaches are considered.
Author

N88-10725*# Maryland Univ., College Park. Inst. for Physical Science and Technology.
STUDY OF PICKUP OF COMETARY IONS IN TURBULENT SOLAR WINDS Abstract Only
C. S. Wu and C. P. Price *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 18 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The influence of moderately strong magnetic disturbances on the ion pickup process near a comet is studied by a test-particle method. The research is motivated by recent observations with ICE and Giotto at Giacobini-Zinner and Halley. In this numerical study, the intrinsic hydromagnetic turbulence is modelled based on the Giotto and ICE data. The time evolution of the distribution function of the newborn ions is investigated. It is found that, when the level of the intrinsic turbulence is sufficiently high, the pickup ions can form a shell distribution function rapidly. The typical time scale for such a process is of the order of a couple of ion gyroperiods. On the other hand, if the turbulence is not strong, the pickup ions usually form an incomplete shell in the initial stage. The results seem to be consistent with available observations.
Author

N88-10726*# Emmanuel Coll., Boston, Mass.
SOLAR ORIGINS OF CORONAL MASS EJECTIONS Abstract Only
Stephen Kahler *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 20 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The large scale properties of coronal mass ejections (CMEs), such as morphology, leading edge speed, and angular width and position, have been cataloged for many events observed with coronagraphs on the Skylab, P-78, and SMM spacecraft. While considerable study has been devoted to the characteristics of the SMEs, their solar origins are still only poorly understood. Recent observational work has involved statistical associations of CMEs with flares and filament eruptions, and some evidence exists that the flare and eruptive-filament associated CMEs define two classes of events, with the former being generally more energetic. Nevertheless, it is found that eruptive-filament CMEs can at times be very energetic, giving rise to interplanetary shocks and energetic particle events. The size of the impulsive phase in a flare-associated CME seems to play no significant role in the size or speed of the CME, but the angular sizes of CMEs may correlate with the scale sizes of the 1-8 angstrom x-ray flares. At the present time, He 10830 angstrom observations should be useful in studying the late development of double-ribbon flares and transient coronal holes to yield insights into the CME aftermath. The recently available white-light synoptic maps may also prove fruitful in defining the coronal conditions giving rise to CMEs.
Author

N88-10727*# Wroclaw Univ. (Poland). Astronomical Observatory.
ON THE ASSOCIATION OF ERUPTING MAGNETIC FIELDS WITH ERUPTIVE PROMINENCES AND CORONAL MASS EJECTIONS Abstract Only
Bogdan Rompolt *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 21 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

A number of space and ground-based observations give evidence that the eruptive prominences, coronal mass ejections (CMEs) and associated shocks are generated by a common cause, i.e., the eruption of the magnetic field on the Sun. Some 60% of the observed CMEs are associated with the eruptive prominences.

It is believed that in reality a much better correlation should be between these events because of observational limitations and of the effect of partial eruption. Some recent results on the formation and evolution of the quiescent and the active region prominences give an idea on the early phase of eruption of the magnetic field with the prominence plasma frozen in. In the latter phase of eruption the magnetic field lifted high into the corona and is seen (as manifested by the cold plasma frozen in) as a system of huge loops - evidently the result of some reconnections at lower heights. The legs of these erupting loops interact sometimes with the local magnetic field, i.e., it often appears to be an active region. In consequence of this interaction the activation of prominences and generation of flares can take place on some occasions as well as ejection of surges and sprays. Author

N88-10728*# Maryland Univ., College Park. Astronomy Program.
RADIO STUDIES OF LARGE SCALE STRUCTURES OF THE SUN'S CORONA AND TRANSIENT ACTIVITY Abstract Only
Mukul R. Kundu *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 22 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The use of meter-decimeter wavelength imaging observations for four different kinds of studies of solar coronal activity is discussed. (1) Large scale structure of the upper corona; daily imaging observations permit comparison of radio images with white light images from space and ground observation, generation of synoptic charts similar to white light coronagraph synoptic charts, and comparison of radio brightness enhancements and deficiencies with bright coronal streamers and coronal holes. (2) Relative positions of type III burst sources and coronal streamers as observed by Solwind experiment on the P-78-1 satellite and by the HAO C/P experiment aboard the SMM; infer the paths of type III emitting electrons in dense coronal streamers, and from multifrequency observations derive electron density distributions above active regions near the limb. (3) Non-flare associated type II/type IV bursts associated with coronal streamer disruption events; such type IV sources have a rather slow velocity (approx = to or less than 100 km/s) CMEs. (4) Meter-decimeter microbursts; these are short duration (2-10 sec) weak-type III-like bursts, produced at the fundamental plasma frequency by plasma radiation processes which have important differences from the standard mechanisms used to explain the strong type III bursts. Author

N88-10729*# Indian Inst. of Astrophysics, Bangalore.
OBSERVATIONS OF THE BRIGHTNESS TEMPERATURE DISTRIBUTION OF THE QUIET SOLAR CORONA AT DECAMETRIC WAVELENGTHS Abstract Only
Ch. V. Sastry *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 23 Prepared in cooperation with Raman Research Inst., Bangalore (India) (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The brightness temperature distribution of the quiet solar corona at a wavelength of 8.9 meters is measured by two types of radio telescope: (1) a 'T' type array with a resolution of 26'X38', and (2) a fan beam interferometer with an E-W resolution of 3'. It is found that the persistent bright regions do not have any angular structure on scales of 6' or less. The daily variations of the brightness temperature of different regions are studied and the possible interpretation discussed. Author

N88-10730*# Maryland Univ., College Park. Astronomy Program.
METERWAVE OBSERVATIONS OF A CORONAL HOLE Abstract Only
Z. Wang, E. J. Schmahl, and M. R. Kundu *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 24 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Meter-wave maps are presented showing a coronal hole at 30.9, 50.0, and 73.8 MHz using the Clark Lake Radioheliograph in October 1984. The coronal hole seen against the disk at all three frequencies shows interesting similarities to, and significant differences from its optical signatures in HeI lambda10830 spectroheliograms. The 73.8 MHz coronal hole, when seen near disk center, appears to coincide with the HeI footprint of the hole. At the lower frequencies, the emission comes from higher levels of the corona, and the hole appears to be displaced, probably due to the non-radial structure of the coronal hole. The contrast of the hole relative to the quiet Sun is much greater than reported previously for a coronal hole observed at 80 MHz. The higher contrast is certainly real, due to the superior dynamic range, sensitivity, and calibration of the Clark Lake instrument. Using a coronal hole model, the electron density is derived from radio observations of the brightness temperature. A very large discrepancy is found between the derived density and that determined from Skylab EUV observations of coronal holes. This discrepancy suggests that much of the physics of coronal holes has yet to be elucidated. Author

N88-10731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CORONAL AND INTERPLANETARY TYPE 2 RADIO EMISSION
H. V. Cane *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 25 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Several observations suggest that the disturbances which generate coronal (meter wavelength) type II radio bursts are not driven by coronal mass ejections (CMEs). A new analysis using a large sample of metric radio bursts and associated soft X-ray events provides further support for the original hypothesis that type II-producing disturbances are blast waves generated at the time of impulsive energy release in flares. Interplanetary (IP) shocks, however, are closely associated with CMEs. The shocks responsible for IP type II events (observed at kilometer wavelengths) are associated with the most energetic CMEs. Author

N88-10732*# Emmanuel Coll., Boston, Mass. Div. of Physics Research.
CORONAL MASS EJECTIONS: THE LONG-TERM VARIATION OF THEIR OCCURRENCE RATE AND THE SOLAR WIND MASS FLUX Abstract Only
David F. Webb *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 26 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Solar Coronal Mass Ejections (CMEs) from the Sun are an important aspect of coronal physics, and a potentially important contributor to the solar wind mass flux. However, despite significant progress in studies of CMEs since their discovery in the early 70's, questions remain about their effects on the interplanetary medium. A study is done of the long-term variations of the occurrence rates of CMEs, of activity tracers related to CMEs, and of the solar wind particle flux. CMEs are most directly detected by scattered electron radiation in white light. To estimate their long-term occurrence frequency and their contributions to the in-ecliptic solar wind mass flux, observed CME rates must be corrected for instrumental duty cycles, detection efficiency out of the plane of the sky, mass detection thresholds, and geometrical considerations. These corrections are evaluated using data on solar CMEs from the spaceborne Skylab, SMM, and SOLWIND coronagraphs and on interplanetary plasma clouds from the HELIOS white light photometers. Variations in the CME rate and the contribution of CMEs to the solar wind mass flux are traced over nearly a complete solar activity cycle.

N88-10733*# Air Force Geophysics Lab., Hanscom AFB, Mass.
WAS THE ECLIPSE COMET OF 1893 A DISCONNECTED CORONAL TRANSIENT? Abstract Only
E. W. Cliver *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 27 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The comet-like feature obsereved in the solar corona by the Lick Observatory eclipse expedition to Chile in 1893 bears an interesting resemblance to the disconnection coronal transient reported by Illing and Hundhausen. Reports of possibly-related limb activity are reviewed to see whether a pre-discovery observation of a relatively rare type of coronal mass ejection was mis-interpreted. The goal of this study is to learn more about the morphology of mass ejections by examining observations that extend down to the low corona of a disconnection event. Author

N88-10734*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR EVENTS AND THEIR INFLUENCE ON THE INTERPLANETARY MEDIUM Abstract Only
JoAnn Joselyn *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 29 (For primary document see N88-10709 01-92)
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Aspects of a workshop on Solar events and their influence on the interplanetary medium, held in September 1986, are reviewed, the goal of which was to foster interactions among colleagues, leading to an improved understanding of the unified relationship between solar events and interplanetary disturbances. The workshop consisted of three working groups: (1) flares, eruptives, and other near-Sun activity; (2) coronal mass ejections; and (3) interplanetary events. Each group discussed topics distributed in advance. The flares-eruptives group members agreed that pre-event energy is stored in stressed/sheared magnetic fields, but could not agree that flares and other eruptive events (e.g., eruptive solar prominences) are aspects of the same physical phenomenon. In the coronal mass ejection group, general agreement was reached on the presence of prominences in CMEs, and that they have a significant three-dimensional structure. Some topics identified for further research were the aftermath of CMEs (streamer deflections, transient coronal holes, possible disconnections), identification of the leading edge of CMEs, and studies of the range and prevalence of CME mass sizes and energies. Author

N88-10735*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ACTIVITY, MAGNETIC CLOUDS, AND GEOMAGNETIC STORMS Abstract Only
Robert M. Wilson *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 30 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Associational aspects of magnetic clouds and solar activity, and of magnetic clouds and geomagentic storms are described. For example, recent research has shown associations to exist between the launch of magnetic clouds directed Earthward from the Sun and, in particular, two forms of solar activity: flare-related, type II metric radio bursts and disappearing filaments (prominences). Furthermore, recent research has shown an association to exist between the onset of magnetic clouds on Earth and the initiation of geomagnetic storms. Based on these findings, STIP Intervals XV-XIX are examined for possible occurrences of Earthward-directed magnetic clouds. Author

N88-10736*# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmntal Sciences.
DYNAMICS OF MAGNETIC CLOUDS IN INTERPLANETARY SPACE Abstract Only c90
Tyan Yeh *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 31 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Magnetic clouds observed in interplanetary space may be regarded as extraneous bodies immersed in the magnetized medium of the solar wind. The interface between a magnetic cloud and its surrounding medium separates the internal and external magnetic fields. Polarization currents are induced in the peripheral layer to make the ambient magnetic field tangential. The motion of a magnetic cloud through the interplanetary medium may be partitioned into a translational motion of the magnetic cloud as a whole and an expansive motion of the volume relative to the axis of the magnetic cloud. The translational motion is determined by two kinds of forces, i.e., the gravitational force exerted by the Sun, and the hydromagnetic buoyancy force exerted by the surrounding medium. On the other hand, the expansive motion is determined by the pressure gradient sustaining the gross difference between the internal and external pressures and by the self-induced magnetic force that results from the interaction among the internal currents. The force resulting from the internal and external currents is a part of the hydromagnetic buoyancy force, manifested by a thermal stress caused by the inhomogeneity of the ambient magnetic pressure. Author

N88-10737*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EXPANSION OF MAGNETIC CLOUDS Abstract Only c90
Steven T. Suess *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 32 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Magnetic clouds are a carefully defined subclass of all interplanetary signatures of coronal mass ejections whose geometry is thought to be that of a cylinder embedded in a plane. It has been found that the total magnetic pressure inside the clouds is higher than the ion pressure outside, and that the clouds are expanding at 1 AU at about half the local Alfven speed. The geometry of the clouds is such that even though the magnetic pressure inside is larger than the total pressure outside, expansion will not occur because the pressure is balanced by magnetic tension - the pinch effect. The evidence for expansion of clouds at 1 AU is nevertheless quite strong so another reason for its existence must be found. It is demonstrated that the observations can be reproduced by taking into account the effects of geometrical distortion of the low plasma beta clouds as they move away from the Sun. Author

N88-10738*# Tennessee Technological Univ., Cookeville.
A NUMERICAL STUDY OF TRANSIENT, THERMALLY-CONDUCTIVE SOLAR WIND Abstract Only
S. M. Han, S. T. Wu, and M. Dryer (National Oceanic and Atmospheric Administration, Boulder, Colo.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 33 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

A numerical analysis of transient solar wind starting at the solar surface and arriving at 1 AU is performed by an implicit numerical method. The model hydrodynamic equations include thermal conduction terms for both steady and unsteady simulations. Simulation results show significant influence of thermal conduction on both steady and time-dependent solar wind. Higher thermal conduction results in higher solar wind speed, higher temperature, but lower plasma density at 1 AU. Higher base temperature at the solar surface gives lower plasma speed, lower temperature, but higher density at 1 AU. Higher base density, on the other hand, gives lower velocity, lower temperature, but higher density at 1 AU. Author

N88-10739*# Wuhan Univ. (China).
A TWO-FLUID MODEL FOR SOLAR WIND FLUID WITH HIGHER ORDER MOMENTS Abstract Only
Jingfang Wang, S. T. Wu (Alabama Univ., Huntsville.), Xinying Jing, and Donghui Xiong *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 34 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

A spherically symmetric two-fluid model for the solar wind with higher-order moments is presented. In this model, continuity, momentum, temperature and heat flux equations for two components (electrons and protrons) in steady solar wind states are simultaneously solved by using a time-dependent method. This work is used to compare solutions of the steady-state solar wind with and without higher order moments, and to study the effects of thermal conduction. The coupling between electrons and protrons is also given special attention. The numerical solutions of the steady-state solar wind in both subsonic and supersonic regions between the Sun and 1 AU are obtained and graphically illustrated. Author

N88-10740*# National Central Univ., Chung-Li (Taiwan). Dept. of Atmospheric Physics.
INTERACTION OF INTERPLANETARY SHOCKS WITH NONUNIFORM AMBIENT SOLAR WIND Abstract Only
J. K. Chao and J. H. Sheu *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 35 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Three interplanetary shock wave events are selected from the plasma and magnetic field data of Helios 1 and 2, IMP-8, and Voyagers 1 and 2 for study of the interactions of a weak interplantary shock with a nonuniform ambient solar wind. These events occurred during the periods 22-26 November 1977, 1-7 January 1978, and 2-5 April 1979, respectively. It is found that the shock surfaces of these events are highly distorted. In addition, a portion of the shock surface may be degenerated into a disturbance which does not satisfy the Rankine-Hugoniot jump conditions. Author

N88-10741*# Los Alamos National Lab., N. Mex.
AN OVERVIEW OF STIP INTERVAL 18: SEPTEMBER 1985, THE G-Z ENCOUNTER Abstract Only c90
R. D. Zwickl *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 37 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The primary period of interest during September 1985 is the few days surrounding the ICE encounter with comet Giacobini-Zinner(G-Z) which occurred at 1102 UT on 11 September. To place into perspective the actual in situ observations measured during the comet encounter it is necessary to understand the prevailing solar and interplanetary conditions. Starting two solar rotations prior to and extending through the rotation after the encounter the interplanetary stream structure was very uniform, similar to the 1973-4 long-lived structure. Prior to the arrival of the corotating high-speed stream at 5 UT on 11 September, ICE was already measuring the effects of G-Z on the surrounding interplanetary medium. An overview of available solar, interplanetary, and ICE data for the cometary interval is presented. Author

N88-10742*# Universidad Nacional Autonoma de Mexico, Ensenada.
COMPARATIVE PLASMA TAILS OF VENUS AND COMETS Abstract Only c90
H. PerezdeTejada *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 38 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

A review of current models of solar wind flow in the plasma tails of weakly magnetized bodies is presented. Measurements conducted by the Mariner 5 spacecraft, the Veneras 9 and 10, and the PVO orbiters, in the Venus tail, and with the ICE spacecraft in the tail of Comet Giacobini-Zinner, reveal common plasma properties which suggest that similar physical processes are operative. Most notable is the observation of decreased flow velocities and enhanced plasma temperatures in the vicinity of their plasma tails. In Venus, the measured velocity and temperature fields are consistent with the effects of frictional forces between the mass-loaded ionosheath flow and the ionosphere along the (magnetic) polar regions of the ionopause. It is argued that similar conditions exist at a cometary ionopause and that the distribution of magnetic fluxes in a cometary tail is controlled by the entry of plasma fluxes from the (magnetic) polar regions of the comet's ionospheric obstacle. This question is further addressed in connection with the two-step shape of the magnetic profile measured across the tail of the comet. It is suggested that the low intensity outer increases of the magnetic lobes are associated with the draping of the interplanetary magnetic field lines around the comet's ionospheric obstacle, and that the higher intensity increases seen in the inner regions of the magnetic lobes are due to an additional compression of magnetic fluxes produced by the entry of plasma particles into the tail.

N88-10743*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Space Science Dept.
OVERVIEW OF PLASMA OBSERVATIONS DURING THE HALLEY FLYBYS Abstract Only c75
R. Reinhard *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 39 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

In-situ observations made by the various plasma experiments onboard Giotto, Vega 1 and 2, Suisei, Sakigake, and ICE during the Halley flybys are summarized and discussed, starting with the phenomena furthest away (pick-up ions, plasma waves) and ending with the phenomena closest to the nucleus (magnetic cavity). Author

N88-10744*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE STATUS OF THE INTERNATIONAL HALLEY WATCH Abstract Only c90
Ray L. Newburn, Jr. and Juergen Rahe (Erlangen-Nuremberg Univ., West Germany) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 40 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

More than 1000 professional astronomers worldwide actually observed Halley's comet from the ground. Preliminary logs from the observers indicate that 20-40 Gbytes of data were acquired in eight professional disciplines and as much as 5 Gbytes in the amateur network. The latter will be used to fill in gaps in the Archive and to provide a visual light curve. In addition roughly 400 Mbytes of data were taken on Comet Giacobini-Zinner. Data will be accepted for archiving until early 1989. The permanent archive will consist of a set of CD-ROMs and a set of books, publication of both to be completed by mid-1990. Data from the space missions will be included but only on the CDs. From every indication, the ground based effort and the space missions complimented each other beautifully, both directly in the solution of spacecraft navigation problems and indirectly in the solution of scientific problems. The major remaining concern is that scientists submit their data to the Archive before the 1989 deadline. Author

N88-10745*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LARGE-SCALE INTERACTION OF THE SOLAR WIND WITH COMETS HALLEY AND GIACOBINI-ZINNER Abstract Only
John C. Brandt (Colorado Univ., Boulder.) and Malcolm B. Niedner, Jr. *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 41 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

In-situ measurements of comets Halley and Giacobini-Zinner have confirmed the accepted basic physics of comet/solar wind interaction. The solar wind magnetic field is captured by the comet through the mechanism of field-line loading by cometary ions and the field lines drape around the cometary ionosphere. With this basic model in hand, the large-scale structure of the plasma tail as revealed by submissions to the Large Scale Phenomena Network of the International Halley Watch is reviewed. The turn-on and turn-off of plasma activity seem consistent with theory. Some 16 obvious disconnection events (DEs) have been recorded. Preliminary results showed agreement with the sector-boundary model; a detailed analysis of all DEs will be required in order to make a definitive statement. A study of plasma activity around the time of the VEGA encounters provides strong support for the sector-boundary model and illustrates once again the power of simultaneous remote and in-situ measurements. Author

N88-10746*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
THE GLOBAL INTERACTION OF COMETS WITH THE SOLAR WIND Abstract Only **c90**
Harry L. F. Houpis *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 41 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The recent in-situ measurements of the plasma-neutral gas environment of comet Halley by the GIOTTO and VEGA spacecraft have confirmed the global theory of the comet-solar wind interaction. The ionopause, cometopause, and bow shock distances are the primary predictions of the model, although various momentum collisional cross-sections can also be estimated. With this greater confidence in the global model, the sharp Sunward intensity decrease in the spatial H2O+ profiles observed for comet Halley between 2.14 AU pre- and post-perihelion are interpreted as the cometopause boundary. This interpretation may then be used to determine the solar wind conditions local to the comet. Author

N88-10747*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR-TERRESTRIAL RESEARCH IN THE SPACE STATION ERA Abstract Only
Charles R. Chappell *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 44 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Because of the immense size of the solar-terrestrial system and its tightly-coupled physical nature, its study requires a carefully planned and coordinated approach using a variety of observational techniques. Of fundamental importance is the simultaneous measurement of the varying Sun, the solar wind, and the Earth's magnetosphere and atmosphere. These multiple measurements require a multi-spacecraft approach with both remote sensing of the Sun and atmosphere and in-situ measurements of the solar wind and magnetosphere. The decade of the 1990s will bring an opportunity to carry out the simultaneous set of measurements using a combination of instruments on missions such as the International Solar Terrestrial Physics Program, the GOES satellites, and the Space Station. For the first time it will be possible to determine solar variability and to sample the response of the solar wind and geospace portion of the environment in a thorough way. The potential opportunities for solar-terrestrial studies during the coming era of the Space Station are disclosed. Author

N88-10748*# Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
SOLAR WIND-COMETARY INTERACTION AT THE IONOPAUSE AND ASSOCIATED PHENOMENA Abstract Only
Alexander Ershkovich *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 45 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Solar wind-cometary interaction at the cometary ionopause (including the tail) is reviewed in the context of recent missions to comets Giacobini-Zinner and Halley. The role of various MHD instabilities is discussed. The apparent marginal instability of the ionopause of the comet Giacobini-Zinner and the stability of the comet Halley (for large wavelength perturbations) are explained essentially in terms of the different solar wind conditions encountered by the two comets. Nonlinear evolution of the instability is discussed. Waves of large amplitude arising due to the instability may intermix the plasma and result in heating and particle acceleration. A number of the observed phenomena found a natural explanation in terms of this mechanism. Author

N88-10749*# California Univ., San Diego, La Jolla.
COMET WEST: A VIEW FROM THE HELIOS ZODIACAL LIGHT PHOTOMETERS Abstract Only **c90**
R. M. Benensohn and B. V. Jackson *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 46 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Comet West passed through perihelion on February 25, 1976. The comet crossed the HELIOS A and B spacecraft zodiacal light photometer fields of view as the spacecraft orbited the Sun, allowing them to record the brightness, polarization, and color of the comet and its surrounding interplanetary medium. Data from the U, B, and V photometers across the tail shows a distinct bluing followed by a slight reddening corresponding to the ion and dust tails, respectively, entering the field of view. The non-Earth perspective of the HELIOS photometers allows a comparison of the tail with Earth observations at the same time. Precise location of the nucleus and tail allow the photometer data to be searched for evidence of the comet bow shock and orbital dust. A brightness bump present in the data before the comet reaches some photometer positions, can be shown to approximately form a parabolic shape Sunward and ahead of the orbital motion of the Comet West nucleus. If this is the comet bow shock or bow compression, then it corresponds to a density enhancement of the ambient medium by 1.5 to 2 times in the vicinity of the comet. The distance of the brightness increase from the nucleus by comparison with Comet Halley implies a neutral gas production rate of approximately 3 times that of Halley. Author

N88-10750*# California Univ., San Diego, La Jolla. Dept. of EECS.
SOLAR WIND EFFECTS ON THE OUTER ION COMA OF COMET HALLEY Abstract Only
K. R. Flammer *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 47 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

A simple two-dimensional model is developed to examine the composition of the cometary ion coma in the region outside the ionopause which is strongly affected by the solar wind. Two-dimensional ion distributions are obtained assuming a cylindrically symmetric ion coma which accounts for the dynamic effects of the mass-loaded solar wind flow around the cometary ionosphere. The results of this model are discussed in the context of analyzing the GIOTTO ion data. Author

N88-10751*# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
THE SOLAR WIND INTERACTION WITH COMETS: A POST ENCOUNTER VIEW Abstract Only
D. A. Mendis *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 50 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The recent spacecraft encounters with comets Giacobini-Zinner and Halley have led to an enormous increase in our knowledge of comets, including their dust, neutral gas, plasma, and magnetic field environments. The latter has in turn led to better understanding of the nature of the solar wind interaction with the well developed atmosphere of a comet. The post-encounter understanding of this interaction is reviewed, underscoring the differences with pre-encounter reasoning. The problems outstanding in this area are emphasized. Author

N88-10752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLASMA-TAIL ACTIVITY AND THE INTERPLANETARY MEDIUM AT HALLEY'S COMET DURING ARMADA WEEK: 6-14 MARCH 1986 Abstract Only c75
Malcolm B. Niedner, Jr., Konrad Schwingenschuh, J. Todd Hoeksema, Murray Dryer, and Patrick S. McIntosh (National Oceanic and Atmospheric Administration, Boulder, Colo.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 51 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The encounters of five spacecraft with Halley's Comet during 6-14 March 1986 offered a unique opportunity to calibrate the solar-wind interaction with cometary plasmas as recorded by remote wide-field and narrow-field/narrowband imaging. Perhaps not generally recognized in the comet community is the additional opportunity offered by the Halley Armada to study the structure of the solar-wind and interplanetary magnetic field (IMF) in three dimensions using five sets of data obtained over similar time intervals and heliocentric distances, but at somewhat different heliolatitudes. In fact, the two problems, i.e., comet physics and the structure of the interplanetary medium, are coupled if one wants to understand what conditions pertained at the comet between the encounters. This relationship is discussed. Author

N88-10753*# Physical Research Lab., Ahmedabad (India).
OCCULTATION OF COMPACT RADIO SOURCES BY THE ION TAIL OF HALLEY'S COMET Abstract Only c93
S. K. Alurkar, R. V. Bhonsle, and A. K. Sharma *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 52 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Enhancements of scintillations of the compact radio sources PKS 2314+03 and 1827-360 were observed at 103 MHz and 408 MHz during 18-21 December 1985 and on 29 March 1986, respectively, when the plasma tail of Halley's Comet swept across them. At 103 MHz the RMS plasma density variation along the tail was 10 and 3.3/cu cm at 0.12 AU and 0.18 AU, respectively, as measured from the comet's position. At 408 MHz it was 1.9/cu cm at 0.036 AU. Comparison of results of these two sets of observations is presented. Author

N88-10754*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
EQUILIBRIUM AND TEARING STABILITY OF THIN CURRENT LAYERS IN MAGNETIC ARCADES Abstract Only c90
A. B. Hassam *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 53 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The MHD equilibrium of a thin, force-free current layer in a magnetic arcade is solved analytically. Various approximations are made in order to achieve a lowest order description that is physically relevant as well as mathematically tractable: The arcade is assumed to emanate from feet that are well localized, the current emanates from a localized sheet within the feet and is relatively weak. The resulting expressions for B (sup arrow) are relatively simple and natural flux coordinates are identifiable. The stability of such a current sheet to resistive filamentation is then investigated.
Author

N88-10755*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
A SIMULATION OF THE IPS VARIATIONS FROM A MAGNETOHYDRODYNAMICAL SIMULATION Abstract Only c75
S. J. Tappin, M. Dryer, S. M. Han, and S. T. Wu (Alabama Univ., Huntsville.) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 54 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Calculations of the variations of interplanetary scintillation (IPS) from a disturbance simulated by a 3-D magnetohydrodynamical (MHD) model of the solar wind are presented. The simulated maps are compared with observations and it is found that the MHD model reproduces the qualitative features of observed disturbances. The disturbance produced by the MHD simulation is found to correspond in strength with the weakest disturbance which can be reliably detected by existing single station IPS observations.
Author

N88-10756*# Academy of Sciences (USSR), Irkutsk.
STUDY OF THE MECHANISM FOR SOLAR WIND FORMATION Abstract Only
V. G. Eselevich and M. A. Filippov *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 55 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

Observations of the corona and solar wind are analyzed and compared with generalized results derived from laboratory-scale experiments. It was shown that a thermal pressure gradient can make a major contribution to a precipitating plasma of the solar wind emanating from coronal holes. It is found that the divergence Phi = (R/R sub solar radius)f of the magnetic field lines, originating from coronal holes, is one of the factors governing solar wind velocity at Earth orbit (R= 1 AU). A decrease in the velocity V sub R = 1 AU from approx = 750 mk/sec down to approx = 450 km/sec may be attributable to an increase in superradial divergence f from approx = 7-9 to 20. The plasma energy flux density F at the base of the coronal holes representing the sources of the solar wind with V sub R=1AE = (450 to 750) km/sec, remains nearly constant, being F approx = (1.4 +/- 0.3) x 10 to the 6th power x ergs/sq cm/sec for the period 1973-1975.
Author

N88-10757*# Saint Patrick's Coll., Maynooth (Ireland). Dept. of Experimental Physics.
AN ACCOUNT OF A FLARE RELATED SHOCK EVENT RECORDED BY THE ENERGETIC PARTICLE DETECTOR EPONA OF THE GIOTTO SPACECRAFT DURING SEPTEMBER 1985 (STIP INTERVAL 18) Abstract Only
Susan M. P. MckennaLawlor, E. Kirsch, P. Daly, D. OSullivan, A. Thompson, and P-K Wenzel (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 56 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The Energetic Particle Detector EPONA flown on the Giotto Mission to Halley's Comet was designed to measure electrons,

protons, and heavier ions (E greater that 20 keV) in the Comet Halley environment and during the Cruise Phase of the mission (EPONA switch on: 22 August 1985 - Halley encounter: 13 March 1986). In September 1985 (STIP Interval XVIII) a well defined shock event was recorded at EPONA in association with a sequence of solar flares and a preliminary account of this event is presented. Author

N88-10758*# Academy of Sciences (USSR), Leningrad.
INTERACTIONS OF OBLIQUE INTERPLANETARY DISCONTINUITIES AND THEIR MANIFESTATIONS DURING STIP INTERVALS 15-19 Abstract Only
S. A. Grib and E. A. Pushkar (Academy of Sciences, USSR, Moscow) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 57 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The generation of slow shock waves as the result of the interaction of Alfven discontinuities with solar wind contact surfaces is considered. The latter are taken to be the boundaries of proton and alpha-particle concentration inhomogeneities. It is found that the intensity of the Alfven discontinuity may be increased as the result of its interaction with the more dense plasma. The converse (i.e., decrease of the Alfven discontinuity's intensity following interaction with a less dense plasma) is also indicated. Also discussed is the generation of a magnetic cloud as the result of the interaction of a quasi-parallel Alfven discontinuity with a dense plasma contact surface. It is shown that the (solar-generated) Alfven discontinuity may then be transformed into non-flare fast and slow shock waves as the result of this interaction. Thus, it is indicated that some fast shock waves in the solar wind may have a nonsolar origin. Author

N88-10759*# Academy of Sciences (USSR), Moscow.
INTERSHOCK OBSERVATIONS DURING STIP INTERVALS 17 AND 18 c90
G. Zastenker, N. Borodkova, Yu. Yermolayev, V. Zhuraviev, V. Lutsenko, S. Klimov, S. Fischer, M. Vandas, K. Kudela, and M. Slivka (Kosice Technical Univ., Czechoslovakia) *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 58 (For primary document see N88-10709 01-92)
Avail: NTIS HC A04/MF A01 CSCL 03B

The Prognoz-10/Intercosmos satellite (Intershock Project) carried out observations from Earth orbit from 26 April 1985 until 11 November 1985, covering STIP Intervals XVII and XVIII. Data obtained during the systematic measurements in the course of STIP Interval XVII and part of XVIII are presented; i.e., hourly averages of the solar wind velocity, temperature and ion concentration, ion flux changes (10 to the -1 to 10 to the -3 Hz), plasma wave parameters, energetic particles flux, magnetic fields, etc. Special attention is paid to solar wind distrubances causing abrupt and large effects on the shape of the bow shock (i.e., on 2 May 1985 and 14 September 1985). Generally, the observation period was very close to a minimum of solar activity and was quiet without significant interplanetary shocks. Author

N88-10760# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 513, MAY 1987. PART 1: (PROMPT REPORTS). DATA FOR APRIL, MARCH 1987 AND LATE DATA
Helen E. Coffey, ed. and John A. McKinnon, ed. May 1987 98 p
(Contract N00014-86-F-0049)
(PB87-204939; SGD-513-Pt-1; ISSN-0038-0911; LC-79-640375)
Avail: NTIS HC A05/MF A01 CSCL 03B

Solar-Geophysical data include: detailed index for 1986 to 1987; data for April 1987 (IUWDS alert periods, solar activity indices, solar flares, solar radio emission, and Stanford mean solar magnetic field); data for March 1987 (solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices, and radio propagation indices); and late data (cosmic ray measurements by neutron monitor Thule January to February 1987, and geomagnetic indices February 1987). GRA

N88-10761# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 513, MAY 1987. PART 2: (COMPREHENSIVE REPORTS). DATA FOR NOVEMBER 1986 AND MISCELLANEA
Helen E. Coffey, ed. and John A. McKinnon, ed. May 1987 31 p
(Contract N00014-86-F-0049)
(PB87-204974; SGD-513-Pt-2; ISSN-0038-0911; LC-79-640375)
Avail: NTIS HC A03/MF A01 CSCL 03B

Contents include: detailed index for 1986 to 1987; and data for November 1986 (Meudon carte synoptique, solar flares, solar radio bursts at fixed frequencies, solar X-ray radiation from GOES satellite, and active prominences and filaments). GRA

N88-10762# Department of Energy, New York. Environmental Measurements Lab.
QUANTIFICATION OF THE BACKGROUND SIGNAL TO SOLAR NEUTRINO DETECTION FROM COSMOGENIC ACTIVATION OF THE ATMOSPHERE
A. delaZerda Apr. 1987 25 p
(DE87-013830; EML-476) Avail: NTIS HC A03/MF A01

Neutrinos are a by-product of the fusion reactions that are believed to generate the energy radiated by the Sun. Attempts to measure the flux of neutrinos from the Sun yield a result that is in disagreement with theoretical expectations. In addition, a time variation of this flux over the 11-year solar cycle has been observed. In this work, we review the solar neutrino problem, examine the main features of the cosmic-ray field at the Earth, and determine the neutrino flux from the decay of positron emitters resulting from the hadronic cascades induced in the atmosphere by galactic cosmic rays. Further, we study the variation of this background through the Sunspot cycle. Our results indicate that this contribution to the neutrino flux is far too low to account for the observed correlation with solar activity. DOE

N88-10642# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
DIAGNOSTICS OF SOLAR CORONAL LOOPS AT INTERFEROMETRIC ANGULAR RESOLUTION
B. H. Foing, M. Faucherre, and L. Dame *In* ESA, ESA Workshop on Optical Interferometry in Space Aug. 1987 p 217-219 (For primary document see N88-10613 01-74)
Copyright Avail: NTIS HC A11/MF A01

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N88-10763*# California Inst. of Tech., Pasadena. Space Radiation Lab.
RESEARCH IN PARTICLES AND FIELDS Semiannual Status Report
E. C. Stone, L. Davis, Jr., R. A. Mewaldt, and T. A. Prince 28 Oct. 1987 38 p
(Grant NGR-05-002-160)
(NASA-CR-180412; NAS 1.26:180412) Avail: NTIS HC A03/MF A01 CSCL 03B

Discussed are the research activities in Cosmic Rays, Gamma Rays, and Astrophysical Plasmas supported under NASA Grant NGR 05-002-160. The report is divided into sections which describe the activities, followed by a bibliography. This research program is directed toward the investigation of the astrophysical aspects of cosmic rays and gamma rays and of the radiation and electromagnetic field environment of the Earth and other planets.

These investigations are carried out by means of energetic particle and photon detector systems flown on spacecraft and balloons.
Author

N88-10764*# Arizona Univ., Tucson. Dept. of Physics.
A PROGRAM TO STUDY ANTIPROTONS IN THE COSMIC RAYS: ARIZONA COLLABORATION
Theodore Bowen 23 Oct. 1987 13 p
(Grant NAG5-879)
(NASA-CR-180702; NAS 1.26:180702) Avail: NTIS HC A03/MF A01 CSCL 03B

The Low Energy AntiProton (LEAP) experiment was designed to measure the primary antiproton flux in the 200 MeV to 1 GeV kinetic energy range. A superconducting magnetic spectrometer, a time-of-flight (TOF) detector, and a Cherenkov counter are the main components of LEAP. An additional scintillation detector was designed and constructed to detect the passage of particles through the bottom of the Cherenkov counter. The LEAP package was launched on August 22, 1987, and enjoyed a 27 hour flight, with 23 hours of data at high altitude. Preliminary plans for data analysis include using the Micro-Vax at the University of Arizona for data reduction of the Cherenkov and S2 signals. B.G.

N88-10753*# Physical Research Lab., Ahmedabad (India).
OCCULTATION OF COMPACT RADIO SOURCES BY THE ION TAIL OF HALLEY'S COMET Abstract Only
S. K. Alurkar, R. V. Bhonsle, and A. K. Sharma *In* Alabama Univ., Huntsville. STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals 14 Sep. 1987 p 52 (For primary document see N88-10709 01-92)
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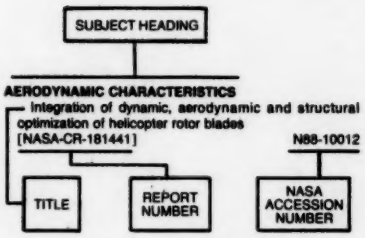

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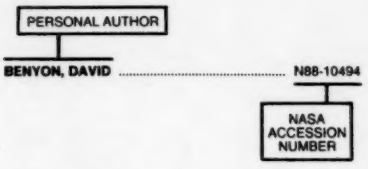

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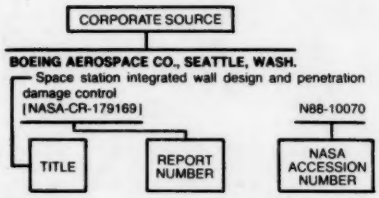

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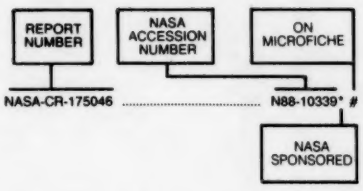

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ENST-87D002 ..... N88-10580 #

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EP-PATENT-APPL-SN-85307273.4 ..... N88-10338
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EP-PATENT-APPL-SN-85308502.5 ..... N88-10164

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EP-PATENT-0-167-304-A1 ..... N88-10337
EP-PATENT-0-170-357-A1 ..... N88-10162
EP-PATENT-0-173-473-A2 ..... N88-10161
EP-PATENT-0-181-700-A1 ..... N88-10338
EP-PATENT-0-181-735-A1 ..... N88-10165
EP-PATENT-0-181-736-A1 ..... N88-10422
EP-PATENT-0-181-747-A2 ..... N88-10336
EP-PATENT-0-182-548-A2 ..... N88-10163
EP-PATENT-0-183-495-A1 ..... N88-10164

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EPRI-NP-5345 ..... N88-10393 #

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ESA-CR(P)-2388 ..... N88-10204 #
ESA-CR(P)-2389 ..... N88-10205 #
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ESA-CR(P)-2392-VOL-2 ..... N88-10219 #
ESA-CR(P)-2394 ..... N88-10405 #
ESA-CR(P)-2395 ..... N88-10240 #
ESA-CR(P)-2396 ..... N88-10220 #
ESA-CR(P)-2398-VOL-1 ..... N88-10022 #
ESA-CR(P)-2398-VOL-2 ..... N88-10023 #
ESA-CR(P)-2399 ..... N88-10206 #
ESA-CR(P)-2400 ..... N88-10406 #
ESA-CR(P)-2401 ..... N88-10080 #
ESA-CR(P)-2403-VOL-1 ..... N88-10341 #
ESA-CR(P)-2403-VOL-2 ..... N88-10342 #
ESA-CR(P)-2403-VOL-3 ..... N88-10343 #
ESA-CR(P)-2404 ..... N88-10024 #
ESA-CR(P)-2406-VOL-1 ..... N88-10073 #
ESA-CR(P)-2406-VOL-2 ..... N88-10074 #
ESA-CR(P)-2406-VOL-3 ..... N88-10075 #
ESA-CR(P)-2406-VOL-4 ..... N88-10076 #
ESA-CR(P)-2408-VOL-1 ..... N88-10077 #
ESA-CR(P)-2408-VOL-2 ..... N88-10078 #
ESA-CR(P)-2409 ..... N88-10537 #
ESA-CR(P)-2410 ..... N88-10538 #
ESA-CR(P)-2412 ..... N88-10079 #
ESA-CR(P)-2413 ..... N88-10489 #
ESA-CR(P)-2414-VOL-1 ..... N88-10501 #
ESA-CR(P)-2414-VOL-2 ..... N88-10502 #
ESA-CR(P)-2414-VOL-3 ..... N88-10503 #
ESA-CR(P)-2414-VOL-4 ..... N88-10504 #
ESA-CR(P)-2414-VOL-5 ..... N88-10505 #
ESA-CR(P)-2415 ..... N88-10207 #
ESA-CR(P)-2420 ..... N88-10102 #

ESA-ITT-AO/1-1,834/85F ..... N88-10203 #

ESA-ITT/AO/1-1866/85F ..... N88-10206 #

ESA-SP-273 ..... N88-10613 #
ESA-SP-1090 ..... N88-10081 #

ESA-TT-1021 ..... N88-10143 #
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ESL-717220-3 ..... N88-10215 #

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FB-1/85 ..... N88-10543 #
FB-2/1986 ..... N88-10382
FB-3/1986 ..... N88-10383
FB-5/1986 ..... N88-10384

FD-1/1986 ..... N88-10373
FD-6/1985 ..... N88-10380
FD-6/1986 ..... N88-10374

FEL-1986-63 ..... N88-10410 #

FF-10/1986 ..... N88-10375
FF-14/1985 ..... N88-10381
FF-17/1986 ..... N88-10385

FFA-MEMO-129 ..... N88-10319 #

FNAL-TM-1464 ..... N88-10672 #

FR-687104 ..... N88-10316* #
FR-687106 ..... N88-10317* #

FTM-8 ..... N88-10213* #

GAO/NSIAD-87-171FS ..... N88-10696 #

GB-PATENT-APPL-SN-8329439 ..... N88-10307
GB-PATENT-APPL-SN-8401412 ..... N88-10124
GB-PATENT-APPL-SN-8406125 ..... N88-10123
GB-PATENT-APPL-SN-8406398 ..... N88-10274
GB-PATENT-APPL-SN-8409627 ..... N88-10306
GB-PATENT-APPL-SN-8411940 ..... N88-10122
GB-PATENT-APPL-SN-8514683 ..... N88-10166

GB-PATENT-2-129-567-A N88-10307
GB-PATENT-2-133-792-A N88-10124
GB-PATENT-2-136-704-A N88-10123
GB-PATENT-2-137-059-A N88-10274
GB-PATENT-2-139-745-A N88-10306
GB-PATENT-2-140-415-A N88-10122
GB-PATENT-2-161-475-A N88-10166

GEPP-TIS-963A ..... N88-10250 #
GEPP-TIS-1016 ..... N88-10249 #

GKSS-86/E/59 ..... N88-10125 #

GMD-246 ..... N88-10281

GRI-86/0144 ..... N88-10684 #
GRI-86/0254 ..... N88-10351 #
GRI-87/0050 ..... N88-10356 #
GRI-87/0114 ..... N88-10129 #
GRI-87/0193 ..... N88-10426 #

H-1283 ..... N88-10026* #
H-1320 ..... N88-10039* #
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HAC-E7324 ..... N88-10106* #

HMI-B-433 ..... N88-10597

IC-AERO-REP-86-04 ..... N88-10014 #

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IC-86/273 ..... N88-10669 #

ICASE-87-59 ..... N88-10519* #
ICASE-87-66 ..... N88-10495* #

ICOMP-87-5 ..... N88-10563* #

IFSR-270 ..... N88-10295 #
IFSR-284 ..... N88-10655 #

IFVE-OTF-86-126 ..... N88-10704 #
IFVE-OTF-86-171 ..... N88-10705 #

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INPE-4199-PRE/1051 ..... N88-10670 #
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INT-PATENT-CLASS-B01J-23/58 ..... N88-10123
INT-PATENT-CLASS-B01J-31/22 ..... N88-10166
INT-PATENT-CLASS-B62D-1/18 ..... N88-10338
INT-PATENT-CLASS-B65H-81/00 ..... N88-10336

INT-PATENT-CLASS-C07C-51/10 ..... N88-10124
INT-PATENT-CLASS-C07C-53/40 ..... N88-10124
INT-PATENT-CLASS-C07C-139/14 ..... N88-10122
INT-PATENT-CLASS-C07F-5/02 ..... N88-10166
INT-PATENT-CLASS-C08G-18/16 ..... N88-10166
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INT-PATENT-CLASS-C08G-73/12 ..... N88-10337
INT-PATENT-CLASS-C08G-75/00 ..... N88-10163
INT-PATENT-CLASS-C08G-81/02 ..... N88-10165
INT-PATENT-CLASS-C08J-3/14 ..... N88-10164
INT-PATENT-CLASS-C08J-9/14 ..... N88-10162
INT-PATENT-CLASS-C08K-5/54 ..... N88-10165
INT-PATENT-CLASS-C08L-9/02 ..... N88-10165
INT-PATENT-CLASS-C08L-33/06 ..... N88-10164
INT-PATENT-CLASS-C08L-61/06 ..... N88-10162
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